THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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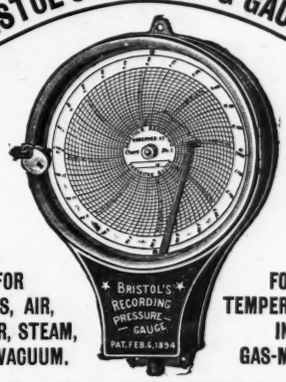

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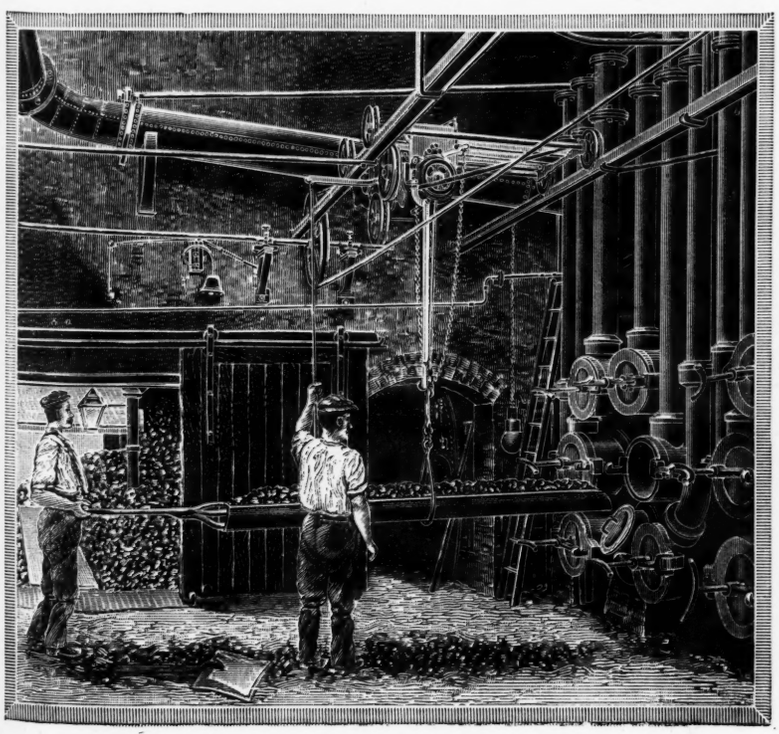

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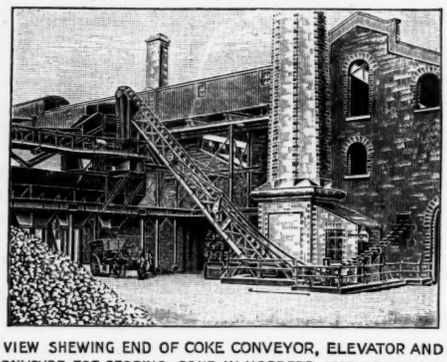
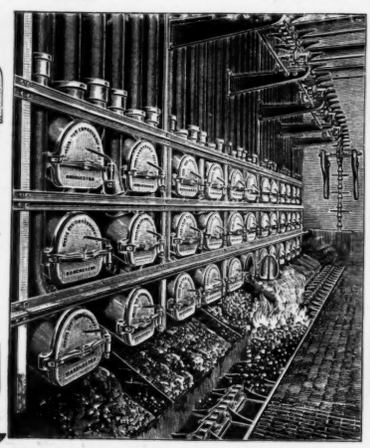
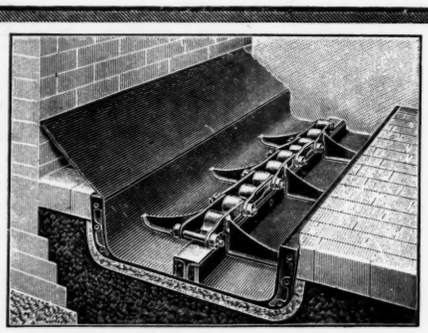


VIEW SHEWING END OF COKE CONVEYOR, ELEVATOR AND CONVEYOR FOR STORING COKE IN HOPPERS AND COKE YARD.



INTERIOR OF RETORT HOUSE SHEWING COKE CONVEYOR.



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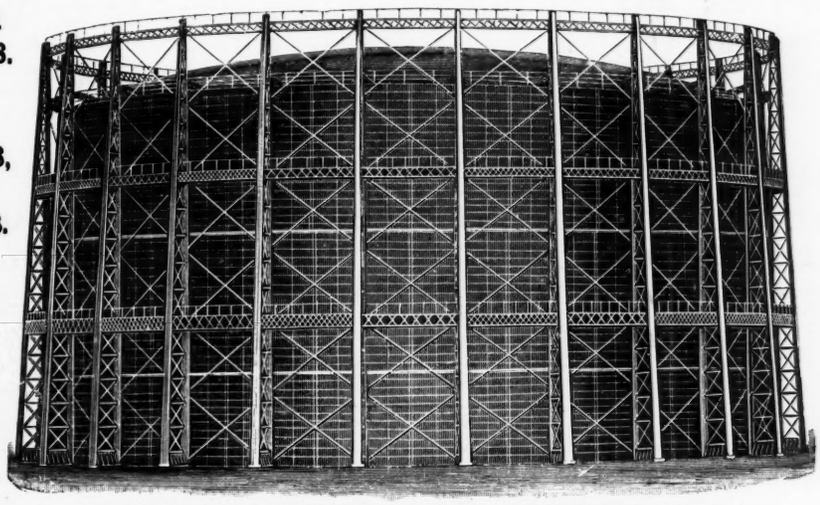

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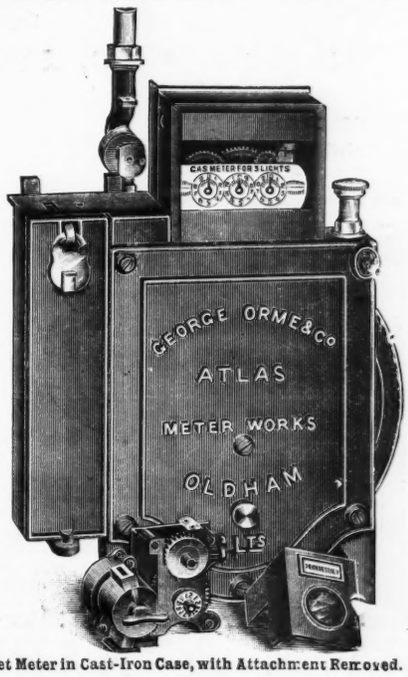

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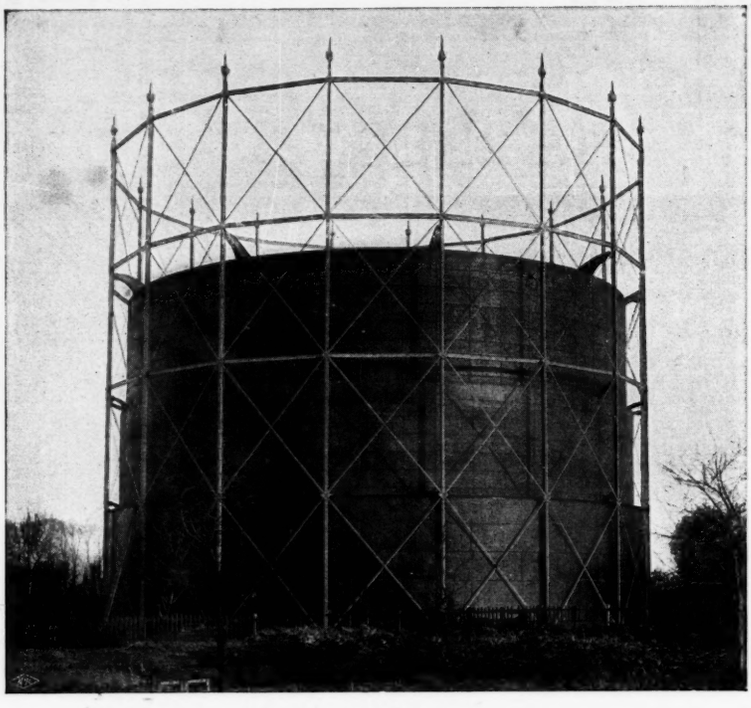
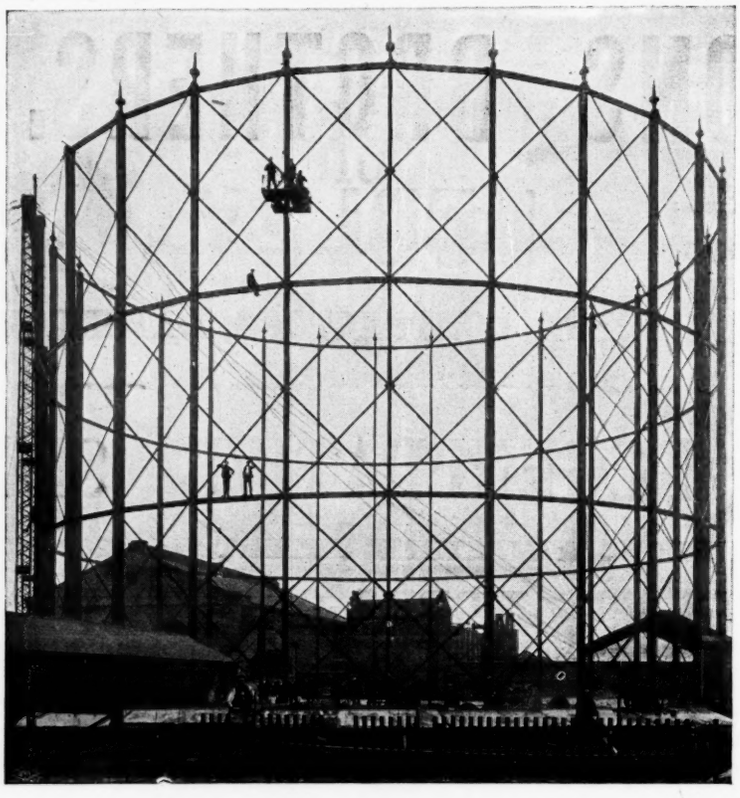


Three-Lift Gasholder and Steel Tank, 90 feet diameter by 14 feet deep, recently erected for the EPSOM GAS COMPANY.



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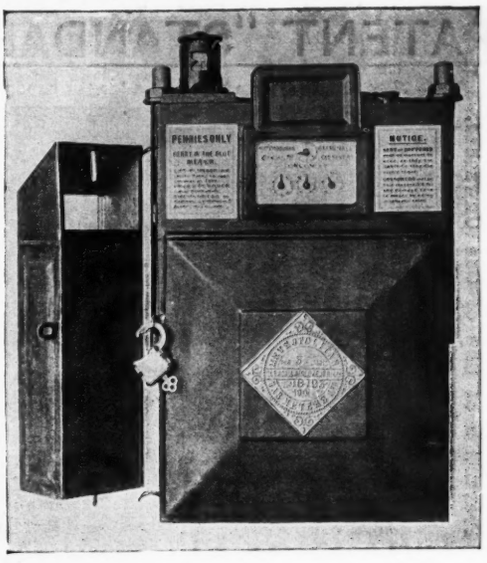

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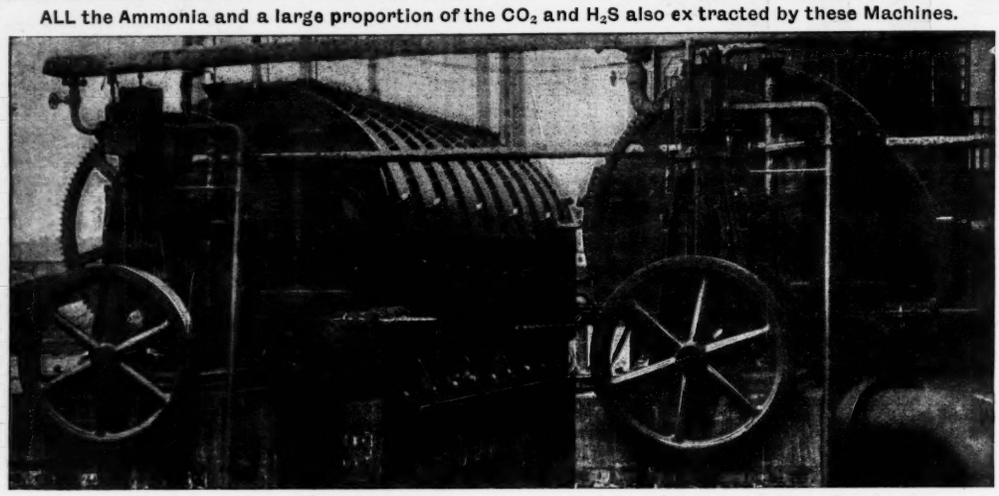

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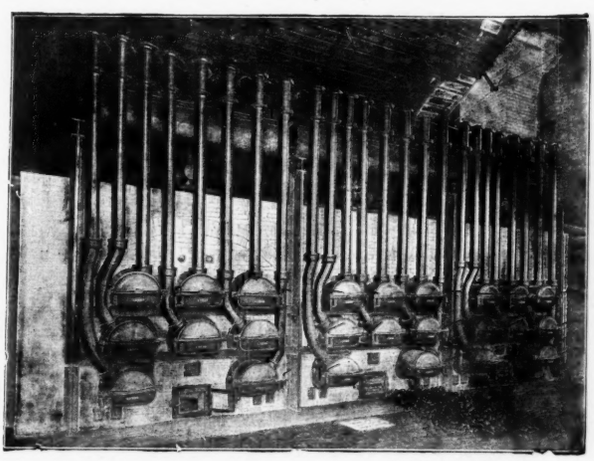

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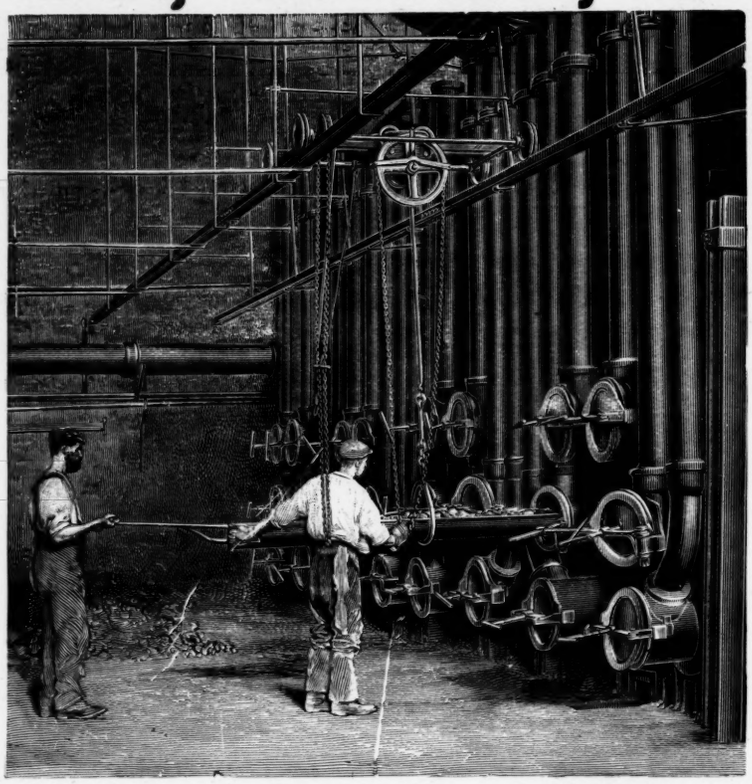

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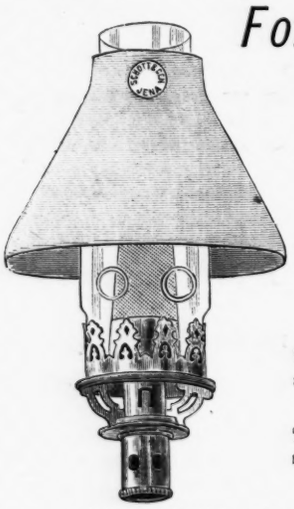

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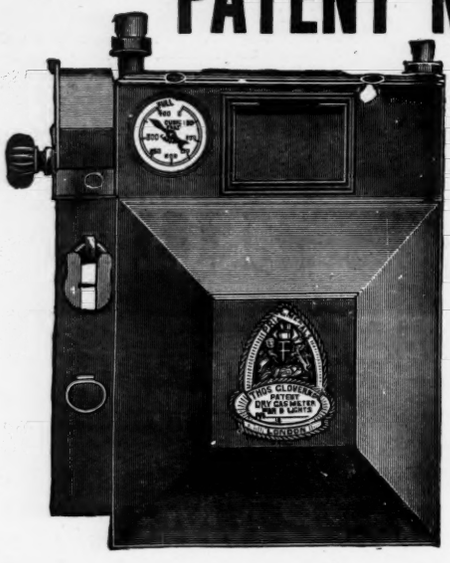

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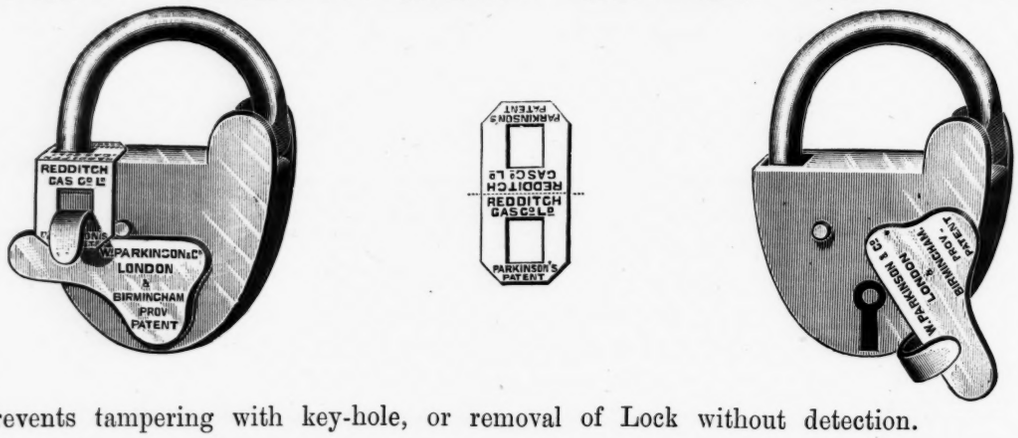

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EDITORIAL NOTES.

The Southern District Association Meeting.

THE Southern District Association held a highly successful meeting last Thursday—the President, Mr. Corbet Woodall, in the chair. Three really good papers were read, and two of them discussed with spirit and point; and the capital idea of applying the influence and machinery of the Association to a serious attack upon the puzzle of naphthalene was fairly launched under most promising auspices. Altogether, it was a meeting which more than justified the existence of the organization. The proceedings amply repaid the pains of those members of the Association who attended—some from considerable distances; and the success of the day must have proved peculiarly gratifying to those who were responsible for the programme. Before discussing the subject-matter of the papers, we desire to emphasize once more the general lesson of the transactions of the Association, on this occasion, for all technicians who may be disposed, for any reason, to disparage the advantage of thus mixing with their fellows. Here were papers to be read, and if possible discussed; and while the quality of the written communications proved to be excellent, the discussions which actually took place largely turned upon points suggested by, rather than comprehended in them. This is one of the chief attractions of such gatherings; and the loss of the positive instruction, and of the incidental sharpening of the wits, on the part of those who stay away, is irremediable. It is indisputable that every manager who attended Thursday's meeting was decidedly the better for it, and in a way that cannot be achieved by any other means. Reading the best reports of what was said and done on such occasions is far from being the same as taking a man's part in them. The kind of reputation among his fellows that invariably, and inevitably, attaches to a man who habitually keeps close within his shell and does not appear in the company of those who would gladly welcome him as an equal, is not often reckoned as much to his advantage.

It will be recognized as a permanent memorial of Mr. Corbet Woodall's year of office in the Association, if the contemplated united attack upon the evil of naphthalene deposits in places where it is not wanted, should be worthily made. Whether or not it is fated to effect its object, is "upon the knees of the gods." At any rate, those who are committed to the attempt owe it to themselves and their associates, who have applauded their enterprise, to have a good try. Even a negative result will be preferable to the conflict of evidence which now stands for all that is known concerning the subject. It seems at a first glance almost ludicrous, as Mr. Woodall remarked, that gas manufacturers who have been only too familiar with the naphthalene trouble for the past thirty years at least, should talk now of starting a concerted investigation into the facts with the hope of discovering a remedy. But, really, this is not at all strange. The evil is one that many have encountered, and every one has accordingly faced in his own individual way. Some have cured it, in their own estimation; and yet it remains one of the bugbears of the gas industry to this day. It coloured the proceedings of the meeting on Thursday. Mr. Charles Carpenter's paper had to do with it; and it cropped up in the talk that followed Mr. Murray's contribution. It is hard to keep from being paradoxical when mentioning naphthalene—not the compound itself, but the trouble of gas managers which goes by the name. The chief point for present consideration is that where the mischief exists, it is a serious nuisance. It is the one thing that makes a gas manager uncomfortable in the face of his friend and rival the electric lighting engineer. Slowly, and almost imperceptibly, the consumer's wet meter has vanished from the Englishman's house (which is also by poetic licence his castle), simply because it constituted an element of uncertainty in the maintenance of the supply. It occasionally stopped working, usually at some inconvenient time; and as towns spread and distances from the residential districts to the gas-works increased, the consequent necessity of sending for a man to come and see to the meter became an intolerable tax upon the consumer's complaisance.

It was nothing but the risk and dread of annoying stoppages that really forced the wet meter out of the English market. That incubus removed, consumers breathed much more freely, and lost one of their most irritating grievances. One may search backwards through many a number of the "JOURNAL" ere he will find an illustrated advertisement of consumers' wet meters for sale. The point is that they did not like them; and the prejudices of gas engineers in favour of the older and theoretically more trustworthy wet gas measurer had to go before the pressure of unpopularity. Nowadays, only vagrant naphthalene remains to qualify the gas manufacturer's boast that his service is reliable. It is this, and this alone, which causes consumers to send to the gas offices complaints of "bad light," "no gas," and so forth. It seems a pity that this one last, lingering defect of the supply of gas cannot be removed. The quest upon which the Southern District Association have embarked is of uncommon difficulty. The labours of the Committee will be long, and may be fruitless. But at least the endeavour is worth making; and if naphthalene is to be eventually classed, with the plague and intemperance, among the incurable of the ills of civilized humanity, it will not be chargeable to the Southern Association.

We have not left ourselves much space to dilate upon the subjects of the papers read at the meeting, or the various interesting points raised in the discussions. Mr. Charles Carpenter's paper, read in his regretted absence, was a further step in the author's demonstration of the advantage of reversibility in the working of condensers, and sent many managers away thoughtful. Mr. Murray made a good story of a relatively small matter of gas-works routine; but he showed how one question opens up another, and gave a lead for a very interesting debate. Mr. Onslow has for the present the monopoly of highest pressure incandescent gas lighting; and his paper again evoked some striking comments. Evidently, a large and increasing number of gas managers everywhere are ceasing to live as industrial hermits in their environments, and are going into business as wide-awake traders in light. The general sentiment might be expressed in the following formula: "Unless one is prepared "to maintain and take care of this system of lighting, it had "better be left severely alone;" this being regarded as applicable to incandescent gas lighting in all its forms. It does occur to an impartial onlooker, however, that when smart and active gas managers take to this additional labour and responsibility, which has come in their way within the last two or three years, their Boards or Committees, as the case might be, should not need prompting to recognize their spirit in a proper manner. Slot meters, gas-cookers, and now incandescent burner maintenance, ought not to be run at the expense of the devoted manager. He deserves some recompense; and he is even more in need of capable and sufficient assistance in working the new departments as they should be worked.

Municipal Electricity Supply and the Interests of Gas Companies.

CERTAIN candid admissions which we considered it well to make public some weeks ago, in respect to the facts of the continued existence and growth of electric lighting undertakings, notwithstanding the effective competition of cheap gas and the cheaper incandescent gas-lights, hugely entertained some of the partisans of electricity who regularly read the "JOURNAL." Some of these esteemed rivals of ours, whose high intelligence, technical ability, or business shrewdness have never been disparaged in these columns, affected to hear in those observations a groan of suffering under the trying hour through which it was assumed that the gas industry is passing before its painful dissolution. As we took occasion to explain, this was a mistaken interpretation of our expressions. What was meant was that the forced municipal activity in continually starting fresh electric lighting schemes creates a false impression in the minds of people with money to invest, that gas must really be getting played out. Such persons would not dream of

putting their money into electricity supply; but they and their financial advisers are disposed to fight shy of gas, on the ground that so much electricity must interfere with the prospects of the industry. An echo of this quite reasonable, but utterly mistaken, opinion made itself heard last week in the Birmingham City Council Chamber, where nevertheless the recommendation of the Gas Committee to take time by the forelock in the matter of acquiring a site for new gas-works which will not be wanted for ten years or so, was adopted by an overwhelming majority.

Our point is that while gas companies and gas engineers cannot prevent local authorities from wasting the ratepayers' money on electrical speculations which can never pay, they can, and in their own and the public interest should, exert a steady pressure of commercial competition by employing to the utmost the means at their disposal, which will act in the same direction as the aforesaid innate financial weakness, and so hasten the descent of these doomed undertakings to the ruin to which they must some day come. Within the ensuing five years, many an already moribund electric lighting concern must come to grief. The Company affair at Hampstead has already shown the way. It has only gone a little before some others. Those municipal ventures which will not face the terrible word "depreciation" must pay the penalty of living upon capital. As they have sown, so must they reap. For the moment, the number of candidates for insolvency obscures the direction in which the crowd is pressing; but there can be no mistake about it, as those spectators who live will see. It was reported the other day that Camberwell is being pushed towards the same course—Camberwell, the region favoured with the South Metropolitan Gas Company's cheap supply and assiduous services! If the municipalizers of the borough were not as blind as bats, they would see something too suspicious in the readiness of the Electric Lighting Companies doing business (?) in the parish to sell their undertakings a bargain to the Borough Council. Not only in Camberwell, but in several provincial towns as well, the local electric lighting companies are discovering that this is an excellent time to sell their brilliant prospects to the local authority. Why?

Of course, the progress of the municipalization of electric light, in London especially, is pushed on by informing the ratepayers that municipal supplies of electricity are cheaper than company services. Naturally, when the local authority is content to work at a loss and make up the difference out of the rates. The "Municipal Journal" for last Friday published a table of charges for electricity of Metropolitan municipalities and companies, to show that the former average less than the latter. The detail that not one of the municipal undertakings is solvent, is not mentioned. By a strange coincidence, the accounts of two of these contrasted concerns—the Kensington and Knightsbridge Company and the Hammersmith Vestry—appear in the contemporary "Electrician." The "Municipal Journal" states that the Company are charging an average price of 4·8d. per unit; while the Hammersmith Vestry's charge is 3·68d. per unit. The Company earned last year a gross profit of 8·69 per cent. on their capital, out of which they placed 2·69 per cent. to reserve, and paid 12 per cent. on their ordinary capital. The Vestry made a gross profit of 5·39 per cent., and had to pay the whole of it, except a few hundreds, for interest and sinking fund. They could not spare a penny for depreciation or reserve; and this after four years' working. Which of the two, the Company or the Vestry, makes the fairer charge for the service?

There will be a merry time when all these municipal chickens come home to roost. We reported last week how the Walker Urban District Council are labouring in their attempt to create a municipal monopoly in electricity supply against the wishes and interests of the local manufacturers, who favour the service of the Walker and Wallsend Union Gas Company. That was only part of the story. It has been explained in a Newcastle newspaper that the Walker District Council are wilfully running counter to the expressed desires of the majority of the manufacturers, who pay half the rates and provide occupation for the whole of the population. The manufacturers had joined their forces to supply themselves with electricity, as they already had with gas, and by the same organization. It was an industrial scheme purely, and the District Council were warned not to meddle with what was none of their business. Notwithstanding this protest, the Council opposed the Company's Bill, and obtained an Order of their own. Since then they have borrowed some money, and entered into a contract with a Newcastle Company to supply them with electricity in bulk. Now the manufacturers simply decline to take the Council's supply at a higher price than they can supply themselves; and the Council are going to law to try to compel them to do this. As the case is put in the local Press: "The desire "of the Municipal Authority appears to be that the large "consumers should be coerced into taking electric power "from what is admittedly a more than necessarily expensive "source, of course to the detriment of their trade, with a "view of benefiting the district to the extent of the profits "which might or might not accrue from the sale of this "electric power." This is the real, not the theoretical, Municipalism. It remains to be seen how it will fare.

Unnecessary Litigation and the Workmen's Compensation Act.

We have before now had occasion to call attention to the scandalous way in which litigation, both unnecessary and vexatious, between employer and employed over questions of compensation for accidents is fomented by the baser sort of lawyer. This objectionable practice received considerable check by the decision of the Court of Appeal (in March, 1900), in the case of *Welland v. Great Western Railway*, by which the action of the County Court Judge in granting an order for only £5 to be paid to the plaintiff's solicitor, who claimed £42, was confirmed. In that case, the defendant Company admitted their liability under the Act of 1897, and offered to pay the plaintiff (a lad) half his wages during the period of incapacity. But the plaintiff's solicitor put in a claim for £320 compensation and costs, upon which the County Court Judge refused to adjudicate.

Another instance of apparently unnecessary litigation came before the Court of Appeal on Friday last, in the case of *Field v. Longden and Sons*. This was an appeal from an award of the Judge of the Sheffield County Court. The applicant for compensation was a bricklayer's labourer, who was injured by an accident in the course of his employment at the end of October last. A fortnight after the accident, the employers, of their own accord, commenced making to the injured workman payments of 15s. a week; being one-half his average weekly earnings. These payments were made, and accepted, for nearly six months—that is, until April last—when a solicitor, acting for the workman, wrote to the employers in reference to the accident, asking for an offer of compensation, and tendering his letter as a notice of injury and claim for compensation. The employers replied that they were paying and were willing to pay, during the period of incapacity, the full compensation provided by the Act. The applicant demanded a lump sum, but subsequently filed a request for arbitration, claiming 15s. per week (the amount the employers had, without waiting for any claim, paid for six months), the contention on his behalf being that his employers had never admitted liability, and that he was entitled to have an award duly registered by the Court.

In view of the obvious and voluntary admission of liability on the part of the employers, entailed by the payment of the schedule compensation—the voluntary character of which would have been of itself sufficient guarantee of its continuance to the unprompted mind of almost any workman—a more certainly unnecessary incurring of costs could not be imagined than this request for arbitration. The County Court Judge, however, held that the applicant was entitled to an award, and made an order for a weekly payment of 15s. during incapacity. The employers appealed, on the ground that no question had arisen between the parties within the meaning of section 1 (3) of the Act, or, in the alternative, that such question, if any, had been settled by agreement, and that therefore there was nothing on which to found the jurisdiction of an arbitrator. The Court allowed the appeal, holding that there was no dispute whatever between the parties, and that no question had arisen as to either of the three matters mentioned in the section—namely, liability for, amount of, or duration of, compensation. The fact of serving a notice for arbitration does not of itself create a question in dispute. That is a very satisfactory finding of the Court, affording necessary protection to employers who voluntarily discharge their liabilities under the Act from the subsequent vexatious interference of lawyers between them and their men, with the attendant cost of proceedings before the County Court. The tender and acceptance of full compensation thus, of itself, appears to constitute an agreement between, and binding alike upon, the parties.

In the case of *Jones v. Great Central Railway Company*, decided by the Court of Appeal on the same day, it was held

that the facts that the man claimed, the Company without dispute paid, and the man accepted, compensation in accordance with the schedule, constituted evidence of an agreement between the parties, a memorandum of which the Company was entitled to have registered by the County Court, although the man had refused to sign that memorandum. This is undoubtedly justice as well as law, and makes for the exclusion of litigation-mongering solicitors. These two appeals cannot be put down to obscurity in the drafting of the Act, yet will be counted, we presume, as instances of the litigation arising from its ambiguity by the critics who are so fond of gibing at it (or its foster-parent), among whom, we regret to note, "The Times" is as bitter as ever. The writer of an editorial article upon the appeals recently heard, which appeared in "The Times" on Friday, shows to what absurdities prejudice can carry a critic. He says: "Hitherto, no one has been able to define the 'serious "and wilful misconduct' which deprives a person injured, "and his representatives, of right to compensation." To anyone with any knowledge of law considering the matter with an unbiassed mind, it is perfectly obvious that such a definition is no more possible nor desirable than a definition of "fraud." Both are questions of fact, entirely governed by particular circumstances and conditions.

Labour in the Coalfields.

THE Sliding-Scale Committee for the South Wales coalfields met on Thursday, by request of the men's representatives; but, as there could be little doubt would happen, the owners declined the invitation to discuss the policy of stoppages recently adopted by the leaders of the men. That the latter should ever have imagined that the owners would consent to open such a discussion after those stoppages had, without their being consulted or in any way considered, been ordered, only shows what curiously perverted notions as to the relations between employers and employed—it is becoming almost absurd to speak of "masters" and "men"—are entertained by Trade Unionists. The owners not only declined to discuss the stoppage policy, but made it clear that they intended to proceed with their action against those who instigated it. They further declined to consider any proposal for a scheme for the joint control of the output, such a proposal having been discussed and rejected by them a year ago.

The workmen's representatives were at pains to disclaim any intention of prematurely breaking up the sliding-scale agreement, or of acting in a spirit of hostility towards the owners, whose interests they professed to be desirous of serving in common with their own. We read that "the "speech of the Vice-Chairman (Mr. W. Brace) on this point "was admitted by both sides to be an eloquent and con-"vincing exposition of the men's attitude." We take leave to doubt that adjective "convincing." We should want a good deal more than eloquence to convince us; and the fact that the owners have no intention (the men had hoped they might have had) of abandoning their proceedings against the "eloquent" gentleman and his colleagues, scarcely looks as if they (the owners) were any more easily persuaded. This professed solicitude of Mr. Brace for the welfare of the colliery proprietors sounds very pretty, but is really too reminiscent of the "moving lines" from Kemble's forgotten play: "Perhaps it was right to dissemble your love; "but why did you kick me down stairs?"

This firm attitude of the owners, together with the general hostility aroused by their proceedings, and the certainty that the "stop" days (which have cost the men some £125,000 in wages) have failed of their object, have given the men's leaders pause. They were to meet yesterday—with what result we do not know as yet—to consider whether they should order any more stoppages. The probability appears to be that they will not do so, at any rate for the present; it being not at all unlikely that a policy of "easy working"—that is, of lessened daily output per man—will be quietly adopted. Another purpose of yesterday's meeting was to formulate proposals, to be in due course laid before the owners, as to a scheme to take the place of the sliding-scale agreement when it expires at the end of next year. It appears certain that the agreement will not be renewed, unless the owners insist upon the maintenance of the sliding-scale principle, in which case a bitter struggle between them and the South Wales Miners' Federation, backed up by the Miners' Federation of Great Britain, would inevitably ensue. Should the owners decide not to insist upon the maintenance of the principle, provided a mutually acceptable alternative can be found, the continuance of peace in the coalfield will depend upon whether the men display a reasonable spirit in the negotiations that must take place. It was agreed, at last Thursday's meeting, that the men should frame their proposals at an early date—the employers promising to give them their consideration; but that any definite agreement as to a scheme to come into force on the 1st of January, 1903, can yet be made between the owners and the men (the latter being still in the enjoyment of an abnormally high rate of pay) is, we think, doubtful in the extreme. Whether, indeed, the opening of such a discussion at this juncture is calculated to improve the prospects of peace, is quite open to question. What those prospects are it is not by any means easy at present to determine; but there does not appear much reason to fear any immediate rupture.

In other parts of Great Britain, two disputes that have been running for some time (one for ten months) have been concluded—the 3000 to 4000 Yorkshire miners that have been on strike over a timbering question having been instructed by the Federation to resume work. In Scotland, the question of wages has not yet become acute; while the threatened trouble in France (which would considerably affect the English market) appears likely to blow over—the French miners having found, at the conference held by the International Committee of Miners at Dover last Thursday, that international labour federations, while they afford opportunity for "wind-bags" to talk and advertise themselves, are of mighty little practical value. "It is understood that Mr. "Pickard, as representing the English miners, held out no "hopes of there being a general strike of English and Welsh "miners in support of the proposed French strike." Mr. Pickard added that the French miners would, of course, have the "sympathy" of, and probably financial aid from, their British comrades; but the Frenchmen are not so far disposed, it would appear, to put pounds into, and receive pence from, the pockets of their "sympathizers." For the present, therefore, it may be said, the labour difficulties that dog the steps of the coal trade do not manifest symptoms of imminent aggressions.

New Streets and Tramways-Subways.

ALTHOUGH no other journal connected with the lighting industries, nor any architectural periodical, has yet joined in our plea for whiteness of frontage in English street building in general, and particularly in the new London streets under construction by the London County Council, we are pleased to notice that the "Electrician" is at one with us in deprecating the feverish haste with which the County Council have rushed to Parliament for authority to construct tramways-subways. Our view of the subject was expressed in an "Essay" published last week, which stated the circumstances; and it is therefore only necessary now to record the fact that at last Tuesday's meeting of the Council the recommendation of the Highways Committee, that application should be made to Parliament for authority to construct pipe and tramways subways anywhere in London, and particularly under the new West Central street, was adopted unanimously. It was of a piece with the ordinary hare brained proceedings of this body, that at the last moment the estimate of expenses of the latter work had to be largely increased by the inclusion of a previously omitted item. This and other little weaknesses of the Council have not escaped notice in the newspapers, and will be remembered against them in Parliament, especially a declaration of policy by the Chairman of the Highways Committee which slipped out, as it were, while the subject was under discussion. This was that the Council should be in a position to appear with an alternative scheme before the Parliamentary Committee which will have the new deep-level subways under consideration next year. Certainly, the Spring Gardens busybodies like to have plenty in hand!

Gas and Water Companies will be well advised to keep a sharp eye upon the Council's performances in reference to these tramways-subways, in case it should be sought to make them pay for the luxury. On the fundamental question of the expediency of these street constructions, in the peculiar conditions offered by London, the "Electrician" is of our mind. The Council can do as they propose with the new West Central street, at a price which they do not know for the present; but that is not to say that the same system will be suitable anywhere and everywhere else. Those amateurs of the subject who fondly imagine that there is something magically easy, cheap, and nice about the kind of structure that has been adopted by New York

or Boston, as compared with anything that is known here, are but deceiving themselves. They must forget the old "underground" railways, that actually make a ring round Central London. How would tramways-subways pierce it? If the two structures occupy the same place in the ground, wherein else do they differ? It may be greatly doubted if, when a tramways-subways scheme gets into the hands of the new County Council Engineer, who knows what underground work in London is, it will come out very easily distinguishable from a good old English railway tunnel, which is made for strength and endurance, whether the hole is burrowed high or low in the soil.

WATER AFFAIRS.

Replenished Reservoirs in the North.

THE truth of the French proverb which assures us that everything comes in time to him who knows how to wait for it, was strikingly exemplified in some of the principal towns of Lancashire and Yorkshire early last week. For the past few months those towns have been suffering from the effects of an unusually severe drought. Water supplies have been curtailed, manufacturing operations interfered with, and canal traffic stopped. Rather more than a month ago, we gave a general indication of the position of affairs. Serious as it then was, it unfortunately became worse as time went on without bringing any rain to replenish the exhausted reservoirs. Something of a climax was reached last Saturday week, when Manchester, which had been affected probably to a greater extent than any of the other places, found itself with only eighteen days' available supply of water. Huddersfield, Halifax, Sheffield, and other towns, were in an extremely critical condition; and the Corporation Water Committees and their Engineers were becoming gravely concerned for the future of their supplies. It is an old saying that when things reach their worst they mend; and this was the case in the present instance. On Monday night last week, the rain which had been so anxiously looked for came—not in a mere shower, but in a veritable deluge. Never was it more needed or more welcome, although, owing to the floods which unfortunately were caused, it was not an unmixed blessing. Throughout the whole of Monday night and part of Tuesday rain fell heavily, and dissipated all the fears of a water famine which the unusual circumstances had naturally engendered.

Some idea of the extent of the downpour may be formed from the statement that in Bradford 3·37 inches and in Huddersfield 2·97 inches of rain were registered in sixteen hours. The effect on the reservoirs of this persistent rain was truly marvellous. In Manchester, the store at Longdendale was increased to about 700 million gallons; and by the end of the week it was brought up to 1412 millions, or sufficient for 46 days, as compared with the 18 days' supply on the 9th inst. Gratifying as this was, the store of water was very much less than at this time last year, when there was enough for 107 days, with a daily consumption 10 million gallons in excess of the present. However, the city has been saved, and that is something for which the inhabitants should be thankful. The Huddersfield reservoirs had been drawn so low that the Water Committee of the Corporation were constrained to accept assistance from the Wessenden Commissioners, who were in a position to release a very considerable bulk of water from one of their reservoirs, so as to allow of an increase in the supply for both manufacturing and domestic purposes. But the rain came opportunely, and in such quantity as to equal in one night almost the entire fall during September and October. Last Friday there were about 215 million gallons in store in the Blackmoorfoot and Deerhill reservoirs. Turning to Halifax, never in its history had rain been more welcome than it was at the beginning of the past week, when it descended over the whole of the gathering-ground from which the water supply of the borough and the surrounding district is drawn. In 24 hours there was an increase of nearly 197 million gallons, bringing up the stock to 303 millions. One reservoir rose 17 feet, another 14 feet, and the smaller ones in proportion. Notwithstanding this, the quantity of water in store is still 720 million gallons less than it was this time last year. Bradford gained 189½ million gallons in 48 hours; but this only raised the quantity to one-third of what it was on Nov. 14, 1900. Keighley came in for a good share of the rain, and badly needed it. On Lancashire Moor, 4·62 inches were registered in the 24 hours between the afternoons of the 11th and 12th inst.; and in two days one of the reservoirs rose 9 ft. 7 in., and the other 10 feet more. The Batley reservoirs were replenished to the extent of 67 million gallons—the water in one of them rising 34 feet; Dewsbury and Heckmondwike gained 100 millions, and Harrogate 60 millions. Heywood and Middleton had their store increased to 110 million gallons, or enough for 53 days.

Sheffield was in a very serious condition when the rain came. The supply to Doncaster had been entirely cut off, and negotiations were in progress with the millowners on the streams for a restriction of the compensation water. Fortunately, relief came from the clouds, and no concession was called for. On Tuesday morning it was found that 17 million gallons had been added to the stock, and by the next day it was increased by about 70 millions; the total storage at the close of the week being between 330 and 340 million gallons, or sufficient for about three weeks' supply. Though relief has been afforded, the position of the city in regard to its water store is still far from satisfactory. From Monday night till Tuesday afternoon last week, Leeds, like Halifax, experienced one of the heaviest rainfalls in its history. On Tuesday morning, it was found that the water in the Fewston reservoir had risen from only 6 inches to a height of 14 feet; while the Eccup and the other reservoirs had been replenished proportionately. The stock of water then amounted to 132 million gallons; while on Wednesday morning it was 558 millions. The total rainfall in the Washburn Valley, the gathering-ground of the city's water supply, up to Tuesday afternoon was 2·25 inches; and it is estimated that between nine and twelve o'clock on Monday night upwards of 100 million gallons of water were impounded. The fall as registered in the city was nearly double that of any month of the present year. While Manchester and the other towns named were suffering the inconvenience of a short supply of water, Liverpool was in the fortunate position of having plenty; and the fact was alluded to with justifiable gratification by Alderman Burgess, the Chairman of the Water Committee, in his address to his colleagues at the close of the municipal year. Not that the watersheds on which the Corporation depend were unaffected by the low rainfall; they had suffered equally with the rest. Nevertheless, the Committee were able to keep up a constant and unlimited supply, not only to Liverpool and the surrounding districts, but to all the numerous places along the line of the aqueduct which are dependent upon the city for water. All the same, they welcomed the addition of 20 inches to the height of the water in the great Vyrnwy lake which four hours' rain brought early last week, and also the heavy flood which occurred at the Rivington reservoir.

The remarkably rapid replenishment of depleted reservoirs above recorded, which was unquestionably the noteworthy event of the past week in connection with water supply, bore witness to the abundance of the rainfall with which this country is visited, and justified the statement which has been repeatedly made that it is sufficient for ten times the present population. The fact that it may be withheld for unusually long periods, as in the present year and in previous summers, should only serve to emphasize the necessity for having ample receptacles for storing it when it does come, and adequate means for conveying it therefrom to the places where it can be usefully employed. The recognition of this necessity is surely one of the primary duties devolving upon all suppliers of water. Neglect to take steps to meet it, whether on the part of Companies or Corporations, cannot be characterized otherwise than as a reprehensible disregard of the requirements of the important public service with which they have been entrusted.

British Association of Water-Works Engineers.—The winter meeting of the Association will be held at the Geological Rooms, Burlington House, W., on the 7th prox. In addition to the ordinary business transacted on this occasion, the interrupted discussions on the papers prepared for the Birkenhead meeting will be resumed. There is the paper by Mr. W. Ingham on the "Design, Construction, and Cost of Open and Covered Service Reservoirs;" and the paper by Mr. A. G. Cloake on "French Practice in the Manufacture of Cast-Iron Pipes" will be brought forward. Since the annual meeting, this paper has been supplemented by one by Mr. S. H. Terry on "English Practice in the Manufacture of Cast-Iron Pipes;" and, to round off the discussion, an abstract of an article which has appeared in "The Engineer" on American practice in the same line of manufacture will be brought into the consideration of the subject.

ESSAYS AND REVIEWS.

PROFESSOR R. H. SMITH ON FACTORS OF SAFETY IN ENGINEERING STRUCTURES.

THE subject of "factors of safety" is one of the first things that impress the mind, and awaken the awed respect, of students of engineering. As a rule, the student enters upon the active pursuit of the knowledge of actualities which constitutes practical engineering instruction, with a reasonably complete preparation in the exact science of mathematics, including geometry. If he has the aptitude for Euclid, he usually entertains an inordinate regard for precise demonstrations and convincing solutions of geometrical theorems and problems. Not to pursue this line of explanation further, which would perhaps bring us into contact with Professor Perry's reflections on this part of the subject, the condition of mind in which his excellent schooling leaves the average boy who has a fancy for engineering, may be described as a belief in the opposition of knowledge and ignorance. What the lad knows, he thinks he knows completely, with no mistake about it. Two and two make four in his philosophy, without any uncertainty or elasticity of meaning. It is the same with all the ordinary accomplishments of the schools. The moment, however, that a boy essays to apply his exact mathematics to the solution of the simplest problem of engineering construction, he is faced with the interposition, between the known data and the result to be worked out, of a variable quantity. This quantity, he is told, is the "factor of safety." Some irreverent critics have called it the "factor of ignorance." The great thing is that it is there, among the significant figures of engineering computations; and the student is not qualified to entertain an opinion respecting its value.

The disturbing influences of the introduction of these uncertain quantities are manifold. Perhaps the worst of all possible ways of treating them is also one of the commonest—to accept the values assigned to them in books as unquestionably true, and work out the formulæ into which they enter as though its result were as reliable as the answer to a sum in arithmetic. Formulæ, thus treated, are blind leaders of the blind. Yet the youthful student is hardly to be blamed if he at first follows slavishly the indications of his text-book. It is just what he has always been trained to do. Fancy any school boy criticizing a rule in his Latin grammar! Or venturing to call in question the excellent Euclid. It would clearly be against Nature. Yet in an engineer's office there are jumbled together the man who guesses at a result by one mental effort, and those who can only guess at one of the data of an elaborate calculation tending to bring out the same, or a similar result. The former is an engineer, exercising his trained udgment; the latter are the students.

Professor R. H. Smith recently delivered an address, as President of the Civil and Mechanical Engineers' Society, in which he took as his main theme this subject of "Factors of Safety," and discussed it with his luminous common sense. A report of the address appeared in full in the "Engineer" for the 11th ult.; and it should be carefully read, and filed away, by every engineering student. Professor Smith began by declaring that, until more intelligent methods than are at present prevalent are introduced to determine the proper values of the factors of safety to be used in designing dimensions for engineering structures, all refinements of scientific theory must remain quite futile. As if this were not a sufficiently hard saying, the speaker went on to declare that in the average practice of European engineers, the uncertainty of the value of the factor of safety used is such as to swamp entirely the utility of any scientific calculation of sections, whether the calculation be refined or only roughly approximative. One's opinion as to the proper factor to use is, as it ought to be and must be, founded on experience. The worst of this conclusion is that the experience is usually only personal and exclusive; while the collective experience of the whole engineering profession on every point of practice—such as (say) the proper scantling for gasholder framing—is difficult to arrive at. Either the examples are not chronicled with sufficient care and particularity, or they are not analyzed with sufficient pains, to make the general experience available for the determination of the proper factors suitable for different circumstances with anything like adequate authority. There is, in short, no certain rule for distinguishing the "light" from the "heavy," in such familiar structures as gasholders. The result is that in precisely the same circumstances different engineers may adopt factors of safety varying from each other by as much as 100 per cent.—say, anything between 3 and 6, or between 4 and 8. This being so, it is clear that the result is uncertain to the same extent. The designer could frequently guess a suitable dimension, without troubling himself to calculate, with as great accuracy as he can guess the factor of safety by which to multiply his theoretically calculated result; and he often does so.

This rough-and-ready procedure is quite justifiable up to a degree. It is sheer pedantry, for instance, to calculate out the strains of a small gasholder when the cheapest scantlings that can be properly employed in its construction are far and away stronger than they need be, if strength were the only consideration. It breaks down, however, in face of such problems as those which confronted Mr. George Livesey when he wanted to build gasholders far larger than anything that had ever been attempted. Then it is that computation must come to the assistance of opinion; and it is here also that the enormously large allowance commonly made for "safety" confronts the designer in all its naked monstrosity. It is commonly held that factors of safety are simply allowances for uncertainty in the quality of the materials or workmanship supplied to the drawings and specification. But an instant's thought shows that a four-fold or five-fold factor is an irrationally large allowance to make on this account. If, as Professor Smith remarks, there is the smallest possibility of the strength of a material being only one-fifth of what it should be, or (we may add) if it is necessary to use five bolts where one would do, simply because the contractor is not to be trusted to put in the only one that is really necessary, then that material ought to be left alone, and that contractor ought not to be allowed to tender for another job.

One need only apply this doctrine of the text-books to other subjects than engineering construction, to see its absurdity. A man does not put on five coats in order to make sure that he is wearing one. The real truth is that where the term "factor of safety" is entitled to any respect, it actually covers other considerations besides strength of the scantling. As Professor Smith rightly claims, even ordinary individual experience is quite sufficient to determine factors of safety within far narrower limits than are generally imagined, if only the definite meanings of these factors, and the reasons that compel the use of much larger sections than result from so-called theoretical calculation, are distinctly understood.

The above declaration strikes us as about the most illuminating criticism of engineers' formulæ that has come under our notice of late. What, therefore, are "factors of safety" in Professor Smith's sense of the term? They are "ratios in which pieces are made stronger than is required by calculation, according to the theory of strength employed, in order to allow for various kinds of uncertainty as to the exact value of the data, and to allow also for corrosion and abrasion." An altogether admirable definition. Sometimes the source of uncertainty is doubt as to the legitimacy or theoretical accuracy of the mode of calculation employed. This element of uncertainty would not exist if our formulæ always agreed closely with a theory of whose accuracy and completeness we were quite sure. We are sure that the same rules of arithmetic will apply to everything that can be numbered. With most engineering formulæ, on the contrary, there is a good deal of assumption, of the existence of which the student at least is completely unaware. It is assumed, for instance, that in a strained member the strain is uniformly distributed over the whole section, which is hardly ever the case. Exactly how wrong the result is, however, is never known. Hence, in the making of machines, calculated strengths are of little use in guiding the constructor to his sizes. He has to provide for many considerations which no formula could really be made to cover.

Formulæ, however, are useful tools for some purposes; and the important point to notice here is that, in cases where it is desirable to adopt a formula as the standard for practice, that formula must of necessity base itself upon the knowledge possessed by the average member of the profession. It is intentionally fixed so that the average practitioner shall not go far wrong. Thus, such a formula will comprise a factor of safety which includes compensation for the average ignorance of the profession. It is a variable quantity. If one man designs merely in proportion to the average stress, he must use a larger factor of safety than is properly used by the man who can and does search out the variation of stress across the section, and makes allowance for it. Thus, probably, a part of the whole factor represents doubt of the theory underlying the calculation; another part is due to uncertainty as to the maximum load to be borne; and yet another to irregularity of the quality of the material employed. Hence it follows that the ordinary factor of safety is really the resultant of four component factors; and Professor Smith thinks it would conduce very greatly to accuracy and rational consistency if these four allowances were always dealt with separately, instead of being lumped together in one multiplier, which effectually hides them from examination.

There are other considerations to be allowed for, such as corrosion and abrasion. The latter comes into play in the case of rubbing or rolling pieces. The former is a very serious matter in respect to many structures which come within the range of gas engineering. All exposed surfaces of bridge and gasholder work are liable to corrosion by atmospheric impurities, and by the evaporation of rain water; and allowance must be made for this in designing dimensions. The allowance to be made here depends on what is intended to be done in respect of periodical painting. Professor Smith lays stress upon the truth that these corrosive and abrasive actions affect the surface only, not the interior of the section. No factor of safety properly so called, therefore, can be used to make these allowances. "The section is not to be made greater in a constant ratio for large and small sections and for different shapes of section. An extra surface layer of material is to be provided, the thickness of which should be judged of from the special circumstances of each case, and which should vary little, if at all, with the size of the section. Thus the ratio in which the section is increased is less the larger the section is, and is less also the smaller the ratio of the periphery to the area of the section. A less proportionate increase of area is necessary for circular and square sections than

for others. As example: ⅛ inch thickness wrapped round a flat section ⅓ in. by 1¼ in., increases it in the ratio 1·8; but the same added thickness round a 1½ in. by 3½ in. section enlarges it in the ratio 1·25 only."

Uncertainty as to the quality of materials figures third in Professor Smith's category. If the piece is calculated for strength only, the governing value is the limit of elasticity. This means the maximum strain the material will bear, continuously applied or incessantly repeated for an indefinitely long time without continually increasing strain. If it is stiffness that is wanted, the quality for which provision must be made is the modulus of elasticity. This is a much less variable quantity than ultimate strength. Thus, if the piece is designed for stiffness and has an excess of strength, the factor of safety that need be used (with reference to the modulus of elasticity) is comparatively small. The ratio in which scantlings should be increased on account of uncertainty as to the quality of material should depend on the care exercised in selecting it. If it can be relied upon, a multiplier of 1½ to 2 should be an amply sufficient factor of safety. The same multiplier is sufficient for the possible maximum load. Professor Smith devotes much pains to the investigation of the case of an oscillating strain, as occurring in some members of a bridge under a moving load. This portion of his address is beyond our scope, since we have limited this appreciation of his work to such matters as more particularly fall within the range of the studies of those who specialize in gas engineering construction. The thanks of all students of engineering, however, are decidedly due to Professor Smith for his most instructive criticism of "factors of safety."

COST OF PROMOTING PRIVATE BILLS.

A NEW parliamentary session is drawing near; and many companies and authorities are now considering what it will cost them to go to Westminster and, if successful, to carry home fresh or enlarged powers. In most cases the costs are of a two-fold nature. There is, in the first place, the financial outlay; and, in the second, the cost in the way of concession which diplomacy may suggest in order to save expenses in the first category, or the concessions which are forced upon the promoters by Parliament or by winning opponents. The latter order of cost cannot be avoided; the financial cost can be in some measure. It cannot be disputed that our present parliamentary system of obtaining powers which are purely local is cumbersome; and that very cumbersomeness makes it expensive. But up to the present we do not remember any complete suggestion for replacing it which commended itself as feasible, or which has been of sufficient merit for the only power who could consummate a change giving it any great consideration.

The idea has more than once been put forward that local inquiries by some properly qualified tribunal—an inquiry somewhat more exalted than the investigation which takes place in the case of an opposed Provisional Order—might with advantage supplant the present procedure of passing a Bill through Parliament. But arguments might be found by the dozen for and against a change from the existing system, and both for and against the local form of inquiry. Off-hand two or three pass through the mind. The parliamentary agents, the lawyers practised and eminent in the art of watching and defending the interests of promoters and petitioners, and the most expert of professionals are all to be found located at Westminster; and the advice of one or the other, or all combined, can in the season be had at the beck and call of all who desire it. That is good and convenient in the preparatory stage of a measure; and it is often found advantageous at later stages. But that very concentration and localization of talent during the Committee period of opposed Bills has its drawbacks—even more so in the Committee rooms of Parliament than in the Law Courts. The synchronous sitting of a number of Committees gives scope to the parliamentary agents, lawyers, and experts; and they take full advantage of it, by putting in as many appearances as possible in various rooms upon Bills in which they have an interest. Who can censure them for making hay while the sun shines? But there is little consolation to the promoters and petitioners in the knowledge that those whom they have briefed and retained are lining their pockets elsewhere while their own case is possibly suffering by their absence, and they themselves are standing by full of solicitude and yet helpless. Frequently we have been present in connection with Gas and Water Bills when the reply on a case has been due, or some legal or technical difficulty has arisen, and no leader has been in the room, and the junior who has been left in charge has been incapable of reply or of dealing with the knotty point with which he has been confronted. In the name of common fairness, can any justification be found for this? And yet fees are required all the same. This is where the local inquiry would bring in its train a benefit to promoters and petitioners—in the individual and constant attention which would be obtained throughout the investigation in the case of an opposed measure.

Then, again, the system is cumbersome in that challenged measures which successfully survive the ordeal of the passage through one House have to be submitted to the second House. But though cumbersome, it has the one advantage that the second House forms a sort of Court of Appeal; and measures of doubtful beneficial purpose (which have escaped in the first House) sometimes, fortunately, receive their *quietus*, and wrongs are redressed. But the appeal is really one-sided. In the case of an unsuccessful litigant in the Law Courts, he has the right of an appeal. In the case of a promoter of a Bill, if he cannot carry his preamble in the first House, he has no right of appeal; and his chance is lost for the session. But, on the other hand, if he is fortunate in the first stage, his opponent may prosecute his attack right through to the bitter end. To the ordinary mortal, there appears to be little justice in a system which permits this one-sidedness. Yet here once more, the argument in favour of a single or local inquiry can be about counterbalanced by arguments for a continuance of the present system of double inquiry, though there is room for great reform in the latter.

Another point which we have heard advanced for upholding the present system is the uniformity of legislation that is obtained. But a more empty and ill-founded argument cannot be conceived by anyone who follows intently a series of Bills dealing with precisely similar matters—location only supplying the difference. On the most simple and trivial questions such as the quality of gas, testing-stations, pressure, and a dozen-and-one other points which crop up on Gas Bills, there is no regularity of decision on the part of Committees even sitting in adjoining rooms. Circumstances may alter cases; but not to the extent found in the proceedings of any session of Parliament. So far as equality of decision goes, the local inquiry could not produce anything a jot less inferior to that which is only too often derived from the present system.

So far we have only shown that if there be any virtue in a local over the present parliamentary procedure, the balance in favour is very slender; and that the mere reduction of the latter to a simple form of local inquiry (the result of which would, of course, have to be ultimately confirmed by Parliament) would not effect any very great saving of expense in most cases. The cost of the promoters and opponents and their retinues of witnesses coming to London would, we are afraid, be more than absorbed by the costs which would be incurred in taking from London a properly constituted tribunal and the inseparable legal and expert attributes, who would be debarred by their enforced temporary isolation giving any close or personal attention to other cases for the time being. But discussion of the subject might alter our view. Anyway we have not to this point shown a method by which the expenses of an application to Parliament can be curtailed. The existing route to the obtaining of new powers is undeniably a circuitous and costly one; but a no inconsiderable amount of cost is incurred for which the system *per se* is not responsible. The licence which the system gives to both promoters and opposing petitioners is conducive to waste and extravagance. On this point a word first as to the latter. Frequently have we commented upon the violation by petitioners of their own liberty in tediously prolonging cases by frivolous bickerings and objections, which have enormously added to both their own and the promoters' costs, to say nothing of the deplorable sacrifice of public time. But comment and protest have little effect; and nothing short of having to pay the costs incurred by their own folly will have effect in putting a stop to the evil practice. In at least two cases last session, opponents of measures were mulcted in costs by Committees; and such a rare proceeding by Committees gives proof of the petty nature of the opposition. The exercise of this power a little more frequently, however, would do much in suppressing litigious opponents and perhaps their misguidance by advisers. But what of the promoters themselves? They, too, in many cases, are largely responsible for wasteful expenditure, through the overmanning (legal and expert) of their Bills. It is not an uncommon thing now-a-days to see a Bill supported by three or four of the pink of the parliamentary bar and one or two juniors. Out of the whole lot only two or three are heard at intervals during the proceedings; and after the opening (sometimes not even then) are they scarcely ever all seen in the room at one time. If perchance they should be, then things must indeed be very slack in the other rooms; and such a condition of things will, as a rule, only be found at quite the fag end of sittings before a recess or towards the close of a session.

Then the excessive plurality of expert and other witnesses is uncalled for. In most cases the local witnesses (who are often called up to Westminster in perfect shoals) only confirm each other's testimony; and Committees know full well this is all they will do. And what more can be said of the expert witnesses? One or two in a case are necessary, both for evidence and for the guidance of the legal advocate. But in some instances several of the recognized experts are retained on one side; and if called into the box, they merely absorb time in supporting the evidence given by the first one or two. Their estimates may vary by a few pounds; but on points of principle and practice they are not likely to disagree in any one particular case. They do occasionally disagree on similar points in different cases if on opposite sides; the argument being that circumstances alter cases. But what then results? The proceedings are simply prolonged by cute counsel in attacking the witness on the variation; while probably counsel himself may have been on the same side in the previous case, and so just as great a sinner. And yet that point may be one which has little bearing on the questions at issue, and a point about which the Committee do not care a rap. But still it is pressed, for no obvious reason other than showing the cleverness of the lawyer, if the ball does not roll the other way and the witness happens to score off it

But this plurality of witnesses has an objection, inasmuch as it seems to other people to indicate either a weak case or a fear of defeat, although this is not always the true reason. We have known cases where several experts have been engaged simply with the object of, by mere force of numbers, impressing fear on the enemy; and other instances are not wanting where several have been retained, through the influence of the promoters' own engineers, simply out of friendliness or with the view of not incurring the displeasure of any among his friends in the higher regions. This is, to say the least, silly. We are loth to think that experts are quite so peevish as to take offence from such a cause, or that they expect any such wholesale patronage.

However, it is in the directions instanced in the last two paragraphs that, while the present system continues, economy may be sought without loss. Perhaps some day Parliament may see their way to stepping in and extending their control over Committee proceedings by defining a limit to which promoters and opponents may go in these respects. While they are doing this (if ever it comes about), they might see if something cannot be done in the way of protecting promoters and opponents from the disadvantages imposed on them by the peregrinations of Counsel during the consideration of Bills. It is, of course, a delicate task to attack liberty of action, but that, it appears to us, is the only thing that can be done, under present circumstances, to bring Committee proceedings and expenses within reasonable bounds. Parliament has not shown any anxiety to tackle the question; and we fear that those who hope that something may be done in the way of regulation will have to wait long before their wishes are realized.

However, the Association of Municipal Corporations are trying to move the "powers" to action. The members have frequently talked over the matter; but with no more result than the accumulation of dismal experiences of stupendous costs incurred in parliamentary expenses. They have now, however, taken a clear step with the idea of getting in the thin edge of the wedge so as to effect an opening for reform. At the instigation of the Town Clerk of Wolverhampton, the President of the Local Government Board has been asked by the Association to receive a deputation for the purpose of bringing to his notice their views as to the "lessening of the cost and inconvenience incurred in the promotion of Private Bills, and of shortening the procedure in regard thereto," as well as "the inclusion in a Public Bill of many of the clauses so frequently contained in Private Bills, and accepted by Parliament." Whether any good will come from this movement remains to be seen. One cannot restrain a little feeling of scepticism over the matter; but still the object is an excellent one, and therefore worthy of any trial of the kind. Some of the members have certainly had startling experiences. There is the case of the unsuccessful Bill for extending the city boundaries of Dublin, which absorbed in costs the trifling sum of £40,000. There is also an instance where a town, with a rateable value of only £40,000, incurred an expense over a Drainage Bill of £10,000; and a like sum was spent in respect of a Bill for a water supply. Another member vouches for the truth of the statement that a certain Private Bill cost £60,000. Of course, these must be regarded as exceptional; but they are sufficient to show to what length the expenses of promoting a Private Bill may be carried. With regard to the second part of the mission of the deputation, one cannot help being struck by the similarity of many of the provisions in Private Bills session after session; and certainly, with regard to gas and water, the General Acts could with much advantage be revised, and many of the clauses now included in Private Bills could, by inclusion in those Acts, receive general application in all future legislation. In fact, a consolidation, modification, and extension of the general Gas and Water Acts would be heartily welcomed. In the view of the Town Clerk of Wolverhampton, a large part of the money now spent over Private Bills goes in "House fees and unnecessary fees, which might be avoided by a modification of the existing practice." In the interests of the ratepayers, and of statutory companies and those whom they serve, it is high time decisive steps were taken with the object of securing a change in the present unsatisfactory and unreasonably oppressive conditions attaching to applications for parliamentary powers.

ELECTRIC LIGHTING MEMORANDA.

Stand-by Electricity Supplies—The Consumer's View—The Wastefulness of Competition—The Obligation to Pay for the "Use" of an Installation.

THE stand-by gas-meter retained at the expense of the gas company, in order that the whilom consumer may indulge in the luxury of electric light with reasonable security against being left in utter darkness in the not unknown event of a breakdown, is paralleled by the alternative electricity supply favoured by some cautious users of the convenience. Sometimes it is the consumer in a sufficiently large way to have a private lighting installation of his own, usually driven by a gas-engine, who takes the liberty of having his wires connected up with the public supply without the least intention of using it except on an emergency. It is easy to see how circumstances may alter such cases, in the opinions of the proprietors of the central lighting station. They receive, we will say, a flattering application from the manager of a large bank, who candidly informs them that he has a private lighting plant in the cellar, with the performance of which he is far from satisfied. Would the electricity supply company, or the corporation committee, do him the favour of sending a meter and making the necessary connection with the mains in order that he may enjoy the solace of their more trustworthy service? Why, certainly! There is not the slightest difficulty about that. In the first place, the applicant is within his legal rights in asking, and it would be turning trade away to refuse him. Accordingly, the connection is made, the additional customer entered upon the books, and all his lamps promptly counted in to make up the pleasing tale of the rapid growth of the undertaking.

Sometimes, of course, it turns out all right for the public service. The consumer does find a greater comfort in taking the supply of current from the central station than in messing about with machinery and accumulators which he does not understand, and in regard to which the skilled attendance necessary is only one more burden of vexation upon an already overworked business man. But as a rule, it is the other way. Having secured his stand-by connection with the street mains, nothing is further from the intention of the banker or merchant than to pay the top price per unit on the maximum demand scale, while he can supply himself with all the electricity he needs for half the money or less. It is a source of satisfaction to know that if the engineman does not turn up any day, the place will not be left without light; and that is all the business gentleman thinks about. The stand-by meter saves the expense of a stand-by man or an extra dynamo. This is the way the consumer looks at it. But the proprietors of the central station take a different view of the circumstances. They have had to spend capital in order to be able to meet the demand which every lamp on circuit may bring upon their generating plant at any moment. Who is to pay for this? There is no real relief in the maximum demand system of pricing the supply differentially, if connections of some scores or hundreds of lamps only come on once or twice in the quarter. This is not the way they expect the game to be played. What is the use of putting up the price of the unit for the first hour, if people decline to have a first hour oftener than, perhaps, half-a-dozen times in the year?

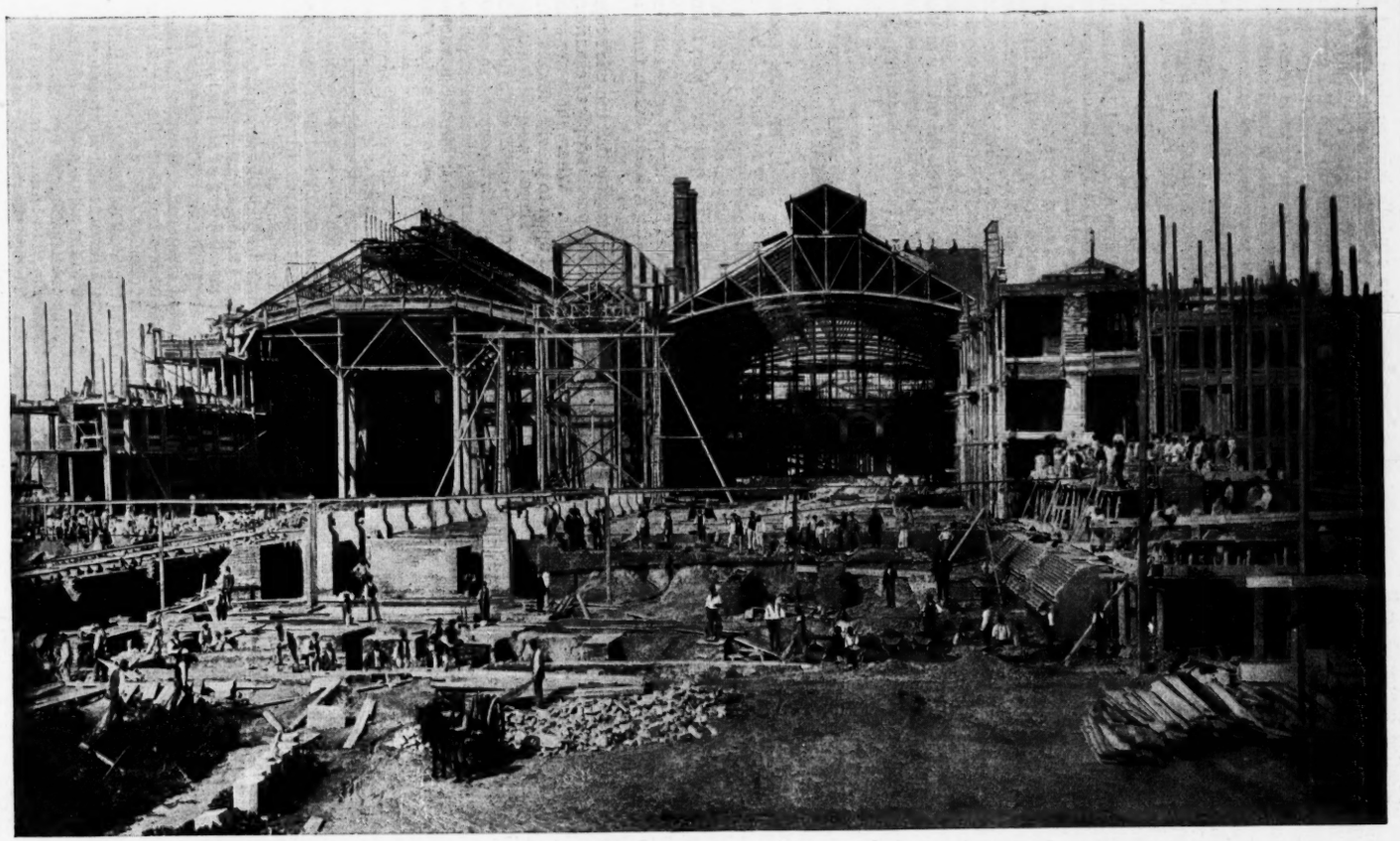
The hopeful electricians who fondly imagine that there is necessarily "great business" in a competing public supply of electricity are liable to be served in the same way. Where there are competing systems, both may be called upon to provide for the total supply of any consumer on demand. There is no question about this. The rival purveyors must be equally eager to do the needful in this regard; or there is no competition properly so called. The splendid economy of this duplicate arrangement was exploded in the case of gas supply half-a-century ago; but the advanced modern electricity supply interests are as yet quite in the dark on the point. They will learn all about it in time, after they have paid for the knowledge at the usual extravagant cost of experience. But meanwhile the working out of this experience is amusing to watch from the outside. There was a lawsuit taken to the Divisional Court last week, in which the plaintiffs were the London Electric Supply Corporation and a Peckham shop-keeper was the defendant. The question at issue was whether the defendant was liable to pay a quarterly sum of £1 6s. 9d. under a "free wiring" agreement to which the plaintiffs were party, which was reserved in this instrument as the minimum payment for the "use" of the installation; the fact being that he had not used any electricity supplied by the plaintiffs. The County Court Judge, before whom the original claim came, thought the defendant was not liable to pay, as he had not used the property in question. The Divisional Court decided otherwise, on the ground that the real consideration was the availability of the installation. What was contracted to be paid for was the right to use the current, and this was immaterial to the actual amount of the use made of it. Consequently, the construction put upon the case by the County Court Judge was declared to be erroneous, and a new trial was accordingly ordered. Though the point is not free from difficulty, one cannot very well see how their Lordships could have found otherwise.

Payment for a "user" appears obviously to be a different thing from payment for an actual use; and it is a distinct gain for the cause of immobile trading enterprise that a reserved minimum payment should be held to mean a payment that must be made in any event. This is, of course, its object; but though the reasonableness of such a condition precedent to the laying on of a supply of electricity may be apparent to every one who is cognizant with the circumstances attending the conduct of this kind of enterprise, it would not necessarily follow that the Courts should countenance the principle. In the case in point, the obligation covered by the agreement was complicated by the inclusion of a third party, whose position in the affair seems to have been ambiguous. In some respects, the consumer was dealing directly with the Wiring Company; and in others the Company had nothing to do with him—the Supply Company stepping between them. It is illustrative of the methods of "free-wiring" concerns that the consumer was bound in perpetuity to pay a surcharge of ¾d. per unit of electricity supplied, with a minimum of 1s. per 8-candle lamp, or its equivalent, per annum. He could only get out of this obligation by paying after five years the original cost price of the installation, as certified by the supply Company, *plus* 20 per cent. and less 1½ per cent. per annum for depreciation. Very fair, for a *gratis* business!

THE VIENNA MUNICIPAL GAS-WORKS.

(*Continued from* p. 1230.)

The Retort-House.



The retort-house with its equipment is naturally spoken of as the most costly part of the whole gas-works plant at Vienna. It is 202 ft. 6 in. wide, inside measurement, and 929 ft. 6 in. long. The side walls are 49 ft. 3 in. high to the roof supports. Referring to Plate I., fig. 1 is a cross section and fig. 2 a longitudinal section of the house. As thirty more settings are to be erected at some later date under each side span of the house, making sixty more in all, the present gable ends, and the bath and dressing rooms at the ends of the house, must be considered as only provisionally established there. Herr Herrmann had originally planned the house with a single roof; but it was decided to make it with a roof in three spans, as shown in the drawings. The central span is formed by twenty rectangular iron lattice columns, 26 ft. 5 in. by 18 ft. The angles of these columns consist of two lengths of U-iron, 11 inches deep, and are joined by diagonal and horizontal ties to one another, so as to form a rigid lattice column. The tops of the columns are connected lengthwise of the house by box girders, and crosswise by lattice girders 41½ inches deep. Inside eighteen of these lattice columns are erected the chimneys for the spent furnace gases. A low roof covers this middle section of the house; and on it are erected, around each chimney, open ventilating lanterns 18 ft. 3 in. high.

The two side spans of the house are each 88 feet wide, inside measurement. Each of the iron roof rafters rests in the middle on, and is firmly secured to, one of the lattice columns; and its second point of support is by means of a moveable sliding bed-plate on the retort-house wall. The iron columns in the middle therefore form the fixed part of the roof structure; while the moveable ends, resting on the outer walls, are free to follow the fluctuations of temperature. The principal rafters are 39 ft. 4 in. apart; and, at intervals of twice that distance, are inserted dilatation contrivances to allow of expansion of the roof longitudinally taking place without disturbance of the structure. Each alternate pair of rafters is secured against displacement by a diagonal wind-tie. The couples of the principal rafters are joined by eight lattice girders 41 inches deep, acting as purlins; and these again are each connected, at distances of 13 ft. 2 in., by angle irons running parallel to the rafters. In the middle of each roof is placed a lantern, open at both sides, 17 ft. 8 in. wide and 12 ft. 5 in. high, and covered with galvanized iron roofing with plank lining. One half of the rest of the roof is of glass, and the other half of slates, with plank lining on wooden rafters. Thus the house is lighted both from the sides and roof. The overlapping sections of the glass roofing are placed nearly 2 feet apart; so that on each roof there are thus provided four continuous openings serving to ventilate the house. Provision is made for gaining access to the roofs for repairs, &c., by four travelling ladders, reached by staircases from the towers in the front of the house facing the coke-yard. The weight of iron used in the columns and roofs of the retort-house is 1558 tons. An illustration is given of the retort-house before completion.

The settings are exclusively of the Coze pattern. There are nine retorts in each, 11 ft. 9 in. long, and inclined at an angle of about 32°. The retorts are 20½ in. wide and 15 in. high. There are 180 settings, in benches of five. The brickwork of the bench has a depth of 9 ft. 10 in., a length of 68 ft. 11 in., and a height of 27 ft. 10 in. The benches are arranged in eighteen pairs, at right angles to the longitudinal axis of the house (see fig. 3, Plate I.). There are 1620 retorts in all, taking charges of 550 lbs. of coal. With good Ostrau coal, each setting of nine was guaranteed by the contractors to yield 98,900 cubic feet of gas per twenty-four hours. One chimney serves for a pair of benches, or ten settings. The 180 settings are intended only to meet immediate requirements; being designed for a maximum daily output of 15,256,000 cubic feet, and an annual output of 3050 millions. The rest of the works has, however, already been constructed for a maximum daily output of 17,658,000 cubic feet, for which the settings also will be extended when required. Hasse-Didier generators, charged with the coke drawn from the three middle retorts, supply the producer gas for heating the settings. The mouths of the generators are on the stage level, for convenience of charging with the hot coke from the retorts. The contractors guaranteed that the consumption of coke in the settings would not exceed

16 per cent. of the weight of the coal carbonized; and this guarantee has been fulfilled in working. The products of combustion, after being utilized for heating the air required for combustion, pass into the flue which runs at the back of, and parallel to, the settings. This flue is 31½ inches square; and where it enters the chimney, a fire-brick slide serves as a valve to regulate the draught. The chimneys, of which there are eighteen altogether on the works, are nearly 115 feet high and 3 ft. 11 in. in width internally, and are lined for 41 feet from their base with fire-brick.

The construction of the retort-house was actually started on the 15th of March, 1897; and considerable trouble was experienced from the bad character of the subsoil. But the building was nevertheless completed by the 1st of July, 1898; and the whole of the 180 settings were ready for use by the end of July, 1899. The space in the retort-house is divided in the following manner: Alongside each of the two principal walls there is a passage-way, 10 ft. 6 in. wide. From these run, towards the middle of the house, the benches of retorts, nearly 71 feet long; and finally there is a central space, 26 ft. 6 in. wide, in which are the chimneys. The benches of settings, placed back to back, are 39 ft. 4 in. apart, axis to axis; hence the clear intervening space is 29 ft. 6 in. The benches are so arranged that they come alternately face to face and back to back.

The generator furnaces stand out 5 ft. 9 in. from the face of the setting, and are 7 feet wide (see fig. 4, Plate I.). The clear space between the faces of the generators is 18 feet wide; and through it run two tramway lines, of 24-inch gauge, for the removal of the coke and clinker in tipping waggons. The floor of the house is of concrete. The roof of the basement is of brick arches, supported by an iron framing resting on cast-iron columns. The drawing stages are 9 ft. 10 in. above the floor of the house. There are openings, closed by trap-doors, opposite the side rows of retorts in each setting, for the coke to fall direct as it is drawn from the retorts into the waggons on the tramway below, where it is sprinkled, and then pushed out of the house. For carrying off the fumes from the sprinkling of the coke, there are two shafts, extending from the roof of the basement nearly to the lanterns in the roof of the house. Most of the vapours, however, pass up through the openings in the gangways. The drawing of the retorts is accomplished with very little assistance after the check-plate has been removed. The pitch which collects at the lower mouthpieces is received in a bucket held for the purpose. This is the only unpleasant operation; and it is one which requires a certain amount of skill.

The charging stages, consisting of ribbed iron plates on an iron framing, stand some 17 ft. 8 in. above the floor of the house. The centre part is open, and protected by a railing. The retorts are charged according to Riegel's system, in which charging receptacles suspended from a rail are pushed along the front of the benches. Each bench has an overhead coal-hopper, holding about 63 tons of coal, for the supply of the five beds of retorts. Each of these fixed hoppers is provided with six outlets, closed by slides, from which the charging receptacles are filled, and are then pushed along to the retorts. A special charging receptacle is provided for each horizontal tier of retorts. The coal is discharged from them into the retorts quickly and uniformly.

Iron staircases are placed in the middle of the house, for passing from one stage to another, and for gaining access to the coal-hoppers and tops of the benches. The machinery for preparing the coal is on that side of the house which faces the coal-sheds. There are eighteen coal-breakers—one breaker for each bench—with elevators and band conveyors. An electro-motor is placed between alternate sets of breaker, elevator, and conveyor, and drives two sets. The coal is brought from the storage heaps in the small tipping-waggons, and is discharged close to the coal-breaker on to a cast-iron grid, through which the small coal falls at once into the elevator pit, while the large coal is shovelled into the coal-breaker, whence the broken coal also falls into the pit. The coal is raised from the pit by a bucket elevator to a height of 60 ft. 6 in. The elevator runs in a closed shoot, in order to avoid the scattering of dust, &c. It discharges the coal into a trough 142 feet long, in which runs a chain conveying band, which carries the coal to the hoppers, into which it falls through openings in the bottom of the trough, which may be closed at will. Each coal-breaker supplies two hoppers. Each breaker and elevator deals with 10 tons per hour.

The bridge and dip pipes are provided with self-closing Didier seals. The wrought-iron collecting main has moveable supports, and Drory outlets and cleansing arrangements. The outlet-pipes are 8 inches in diameter, and take both the gas and the condensed products. Each outlet has a special valve by means of which any setting may be shut off. The collecting mains for each bench are nearly 16 inches in diameter. From these the gas passes into four distinct foul mains, which are attached to the main columns of the house. Provision is made at intervals to meet the expansion and contraction of these mains (see figs. 1 and 2, Plate I.). These four mains divide the working of the house into four sections, as is shown by fig. 5, Plate I. There are two tar-mains placed beneath these four mains; and they unite in one main, nearly 16 inches in diameter, at the east end of the house. This main leads to the separating tank, which precedes the tar and liquor wells. The four gas-mains in the retort-house gradually increase in diameter from 16 inches to nearly 40 inches, which is their diameter as they emerge from the house at its east end. Here there are vertical connections to underground mains of the same size, leading to the condenser house. Several views of the exterior and interior of the retort-house were given in the "JOURNAL" for March 26 last.

(To be continued.)

THE ANNUAL REPORT ON TRADE UNIONS.

THE annual report for 1900 by the Chief Labour Correspondent of the Board of Trade on Trade Unions, does not provide evidence of any material growth of Trade Unionism among the working classes of this country. Indeed, considering the extremely active condition of trade throughout practically the whole of last year, the increase in the membership of the Unions is considerably less than might have been expected. Excluding the Coal Mining Unions, the total membership rose from 1,391,660 to 1,422,373—an increase of only 30,713, or just over 2 per cent. Not much satisfaction for Trade Unionists is to be found in those figures. The Coal Mining Unions show an increase of nearly 20 per cent., from 409,209 to 482,743; but this was almost entirely due to the increased number of men employed, though a portion of the increase was certainly owing to the constant pressure exercised by the Union colliers over their non-Unionist fellows. Frequently, throughout the coal "boom," the Unionists at the collieries threatened to strike if the non-Union men did not join, with the result that the employers, rather than have a stoppage at a time of active trade and high prices, either discharged the non-Unionists or else persuaded them to join the Union.

Consequent upon the absence of serious labour disputes, and the generally high level of wages, the funds of the Trade Unions increased last year much more rapidly than did the membership—the total funds in the hands of the 100 principal Unions rising from £3,283,000 to no less than £3,767,000 in the course of the twelve months. The accumulated funds have steadily increased since the end of 1893 (during which year the great coal strike caused a considerable depletion); the total at the end of that year being only £1,381,000, or little more than one-third of the present accumulated balance. The funds of the Mining Unions have increased still more rapidly than the aggregate. From £121,000 on the 1st of January, 1894, the balance in the hands of the Unions included in the 100 principal Unions rose to £564,000 by the end of 1899, while during the past year it was increased by a further £157,000; making a total of £721,000 in hand on the 1st of January, 1901. This represents a sum of more than £3 per member; so that the total funds of all the Coal Mining Unions at the present time cannot be far short of £1,250,000—a rather formidable war-chest.

The richest Unions are those in the metal, engineering, and shipbuilding trades, the funds of the principal of these amounting to £1,195,000, or over £5 per member. The Textile Unions also reach to close upon £5 per member. The average amount of funds per head in the 100 principal Unions at the end of 1900 was £3 5s., as compared with only £1 15s. 10d. at the end of 1892. Since the beginning of that year, those Unions, an analysis of whose accounts is given, expended in all some £13,500,000, of which over £8,000,000 went in "friendly benefits" to the members—unemployed allowances, sick, superannuation, and funeral benefits, and so forth; about £2,750,000 (or 20 per cent.) was spent on disputes; and a similar sum was absorbed by working expenses. The special liability of the coal trade to be disturbed by labour troubles is strikingly evidenced by the fact that, while the average percentage of "dispute" expenditure is, as just stated, about 20 per cent., the Mining Unions in the past nine years disbursed in strike pay 40 per cent. of their total expenditure. During 1900, however, the amount so spent was very small, comparatively speaking, in the case of the Mining Unions; while the total dispute expenditure of the principal Unions was less than in any of the past nine years except 1899, and only about one-half the average.

The Unions connected with the gas industry did not make much headway last year, the Gas Workers and General Labourers' Union in fact progressing slightly backwards. The membership at the end of 1899 numbered 48,030; a year later it was 47,979. During that period, however, the funds in hand increased from £7015 to £8449, the latter sum being equal to no less than 3s. 6¼d. per head, or not quite a day's pay apiece. The Union spent some £22,695 in the past year, of which rather more than half—to be exact £11,402—went in "working expenses," a not inconsiderable sum. A further £4667 went to swell the funds of "federations and other societies, &c.;" £6533 was spent on disputes; and the magnificent sum of £83 was expended in "other benefits and grants to members." Not much of the "friendly society" about this particular organization!

That formidable body known as the Gasworkers, Brickmakers, and General Labourers' Union, succeeded last year in increasing its membership from 4009 to 4075; while its funds decreased from £2966 to £2900. This represents about 14s. 3d., or three days' pay, per member. Working expenses reach to just over 5s. per head per annum. This organization is selected as one of the 100 principal Unions in Great Britain—a selection which calls attention to the fact that of these 100 Unions, 68 have together a membership of only 304,500, or less than 5000 per Union. Apart from the few largest industries, in fact, Trade Unionism has no real hold upon the English working classes—less than one-sixth of their number being included in its ranks.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1332.)

THE course of events in the past week was not calculated to improve the aspect of things on the Stock Exchange, or to stimulate the activity long looked for and long deferred. The tone throughout was variable and vacillating. Firmness ruled at first in view of the adjustment of the Franco-Turkish difficulty, and a belief that things in South Africa were really getting on a bit faster. Then came storms and gales and interruption to business. The cheering item of an easy settlement of the fortnightly account succeeded. Then ensued a less rosy view of progress with the war, and the week closed in fog and gloom. But with all the ups and downs, changes in price do not amount to much; and there were about as many one way as the other. In the Money Market there was a brisk demand, and the supply was not superabundant. In the Gas Market, business was on the whole no more than moderate, and no one single issue was conspicuous for disproportionate activity. But there was a good, strong tone to be noted as prevailing throughout the list, and some nice advances in quotation made, coupled with a fair promise of better things to come. In Gaslight issues there was rather less doing in the ordinary than the usual weekly average of late, but the tendency showed out particularly firm. Good figures were marked daily, and before the close stock changed hands at top price more than once. The secured issues were not remarkable in any way. A moderate amount was done in South Metropolitan at about middle price, without any show of a possible improvement. Commercials were not dealt in at all. The Suburban and Provincial group were very quiet; and the only move in the London market was an advance in Alliance and Dublin. But at the Mart on Monday, some parcels of shares unquoted in the Exchange realized good prices after brisk competition. In the local Exchange, Sheffields were quoted at an advance. The Continental Companies showed much more animation than of late—especially Imperial, which was in good odour, and scored a nice advance. Among the remoter undertakings, Bombay and Monte Video were higher; but River Plate debentures receded a point. In the Water Companies, business was at about its usual rate of speed; but there were more fluctuations in price. These were apparently the outcome of circumstances affecting individual cases. There was no dominant factor influencing the Companies *en bloc;* and the market apparently has not yet begun to concern itself with the struggle over them in the next session of Parliament.

The daily operations were: Very moderate business in Gas was done on the opening day; but prices in general were steady. Imperial advanced 1. In Water, Southwark ordinary receded 3. Tuesday brought no increase of business; but firmness still ruled throughout. Alliance and Dublin new rose ⅓. In Water, East London was 2 lower. Wednesday was a little busier, but nothing changed. In Water, Lambeth moved up 2. Thursday was a quiet day, and Gas quotations remained undisturbed. In Water, Kent rose 5. Friday was the busiest day of the week; and Imperial gained 1 more. In Water, Kent had a further rise of 2. Saturday was quiet, and unchanged.

THE EDUCATIONAL WORK OF THE AMERICAN GASLIGHT ASSOCIATION.

IN the preliminary notice of the proceedings at the recent annual meeting of the American Gaslight Association which appeared in the "JOURNAL" for the 5th inst., it was incidentally mentioned that a report was received from the Education Committee, or rather from the Trustees of the Gas Educational Fund of the Association, the Chairman of which is Mr. Walton Clark. It dealt with the work of the Trustees in the year ending the 30th of September; and as our readers have already been apprised of the existence of the fund, it may be of interest to extract a few particulars in regard to it. It may be remembered that it was established about three years ago by subscriptions of the members of the Association, mainly for the purpose of encouraging and guiding the efforts of those employees of gas companies who, lacking the advantages of an extended education, are anxious to acquire knowledge that will be of service to them in their business. This object has been attained by the Correspondence Class, which works under the direction of the Secretary, Mr. Alfred E. Forstall. This class now contains three sections, known as the second, third, and fourth—the second being in its third year of work, the third in its second, and the fourth in its first. Each of these sections receives its own set of questions, which are made to differ as much as possible from those sent to the others, although each section goes over the same ground, during its three years' course, as that covered by preceding sections. The second section will complete its work at the end of the present year, and a fifth section will be formed at the same time from new applicants for admission.

Employees of gas companies who are not graduates of universities or technical schools, or holders of college degrees, are eligible for membership, with the full privileges of the class, without the payment of any fee. In September last year, a rule was made that, in future, no such graduates would be admitted to full membership of the class, but that they could, upon payment of an annual fee of $5, be admitted to a special section, the members of which would receive the questions and answers as issued, but would not be entitled to the individual attention given to the regular members. The object of this rule, as will be seen, was to ensure that the benefits of the work would accrue chiefly to those who, having had the fewest educational advantages, were the most in need of the assistance given by the work of the class.

The following is the method of instruction: A set of twelve questions is sent out every three months. Answers to each set of questions are due within two months after the date at which it is sent out. In the preparation of their answers the members of the class are at liberty to use any sources of information at their command, except the answers to such questions as have been previously used, which are published in the "Proceedings" of the Association. They are also at liberty to consult the Secretary in regard to any question which they do not understand, or upon which they are unable to obtain any satisfactory information by the means at their disposal. All the answers received from the members of the regular class are examined by the Secretary, and to each of such members is sent a criticism of his work, based upon this examination. Each member receives also a set of the answers to the questions, prepared by the Trustees. Both the criticisms upon the answers of the students to any set of questions and the Trustees' answers are sent out with the next set of questions. Any member of the class who fails to send in his answers to any set of questions within the time specified for the receipt of them, and does not furnish to the Secretary a good reason for such failure and secure an extension of time, or, having secured such extension, still fails to send in his answers, forfeits his membership, and is excluded from the class. A member so excluded, if still eligible for membership, may, upon application, re-enter the class as a member of the next section formed, either at the beginning of the next class year, or at a point during such year corresponding to that at which his membership ceased in the preceding year. Members of the class who send in answers to each set of questions issued within the time originally specified for their reception, or within any extended time which may be granted, will be continued in the class for three years; but at the end of this time their membership ceases by limitation.

It has been already stated that the class contains three sections. In the second there are 22 members, in the third 30, and in the fourth 36; making the total membership 88. There are two special students receiving the questions and answers with the fourth section. With regard to the financial position of the fund, the receipts in the period covered by the report amounted to $4202, the expenditure to $3858. The surplus in the fund now amounts to $3444, and is invested in approved securities.

ELECTRICITY SUPPLY UNDERTAKINGS.

Board of Trade Returns.

IT may be remembered that on the 1st of April last the House of Commons ordered, on the motion of Mr. Bartley, the Member for North Islington, returns to be made in respect of authorized electricity supply undertakings in the United Kingdom, in the hands of Companies and Local Authorities, for the year 1899. The returns were issued last Friday, and they furnish a good deal of instructive information. The particulars are presented in the form adopted in the returns relating to gas undertakings, and those for the Companies are tabulated under sixteen headings, as follows: (1) Name. (2) Date of Act of Parliament or Provisional Order. (3) Area of supply. (4) Total capital authorized at end of year. (5) Total capital called up at end of year. (6) Total borrowing powers. (7) Total loan capital borrowed at end of year. (8) Total capital expended at end of year. (9) Receipts during the year for (*a*) public lighting and (*b*) sale of energy, &c. (10) Expenditure on maintenance, &c., during the year. (11) Reserve fund (*a*) provided during the year, with interest, and (*b*) total at end of year. (12) Depreciation fund, do. (13) Net profit or loss for the year. (14) Price per Board of Trade unit—maximum authorized and charged. (15) Quantity of energy, in units, generated and sold. (16) Dividend paid on ordinary shares. The returns relating to Local Authorities furnish similar particulars tabulated under fifteen headings. Nos. 1 to 3 are the same as for the Companies. In column 4 is set forth the amount of loans authorized, borrowed, and repaid; in column 5 is shown the total capital expended at the end of the year. Nos. 6 and 7 are similar to Nos. 9 and 10 in the Companies' returns; No. 8 shows the gross profit or loss before providing for interest and sinking fund, &c.; No. 9, the interest on loans; Nos. 10 and 11 give the sinking and reserve funds set apart during the year, with the totals at the close, exclusive, in the case of the sinking fund, of the amount of loans repaid; No. 12 shows the net profit or loss after making this provision; No. 13 indicates the percentage of net profit or loss on the total capital expenditure; and Nos. 14 and 15 are similar to Nos. 14 and 15 in the Companies' returns.

Particulars have been supplied by 15 London and 46 Provincial Companies, who had at the close of 1899 a total authorized capital of £8,854,444, of which £6,559,427 had been called up. The amount of loan capital raised at that date was £2,262,695; and the total capital expended, £9,253,249. The revenue from

public lighting amounted to £25,743; from the supply of energy, &c., to £1,102,386. A sum of £669,300 was expended on maintenance. The reserve fund provided was £176,108, with £378 interest; the total at the end of the year being £273,060. The depreciation fund was £99,180, with £349 interest: and the total was £393,039. The net profit for the year was £345,000. The prices charged ranged from 8d. down to as low as 2¹d. (Cork) per unit; but in several cases the figure charged is not given. The highest dividend paid was 14½ per cent. (St. James's and Pall Mall); the lowest, 2 per cent. (Northampton).

There are returns from 126 Local Authorities, including 9 in London. The total amount of loan capital authorized at the close of the period covered was £9,840,998, of which £9,504,558 had been borrowed and £454,689 repaid. The total capital expended was £10,741,900. The receipts for public lighting amounted to £140,409; for the supply of energy, &c., to £1,039,442. The expenditure on maintenance came to £672,584. The gross profit was £511,805. The interest paid on loans at the close of the year was £255,478. The sinking fund provided was £195,130, with interest £3936; the total at the end of the year, excluding the amount of loans repaid, being £182,184. The reserve fund provided was £35,995, with interest £2615; the total being £148,441. The net profit was £13,860. The columns showing the percentage of net profit or loss on the total capital expenditure are instructive. In 49 cases there was a loss—the amount ranging from £10·5 down to £0·1; the percentage of net profit ranging from £0·1 up to £5·8. The price charged varied from 1d. up to 8d. per unit; but, as in the case of the Companies, the figure is not stated in several cases. In certain instances the returns are up to March or some other date last year, and are for less or more than twelve months.

In both returns, particulars are wanting as to the number of units generated and sold in certain towns. There is nevertheless much in them to interest our readers, though they are somewhat late in making their appearance.

PERSONAL.

Mr. Thomas Holcroft has been appointed Chairman of the Ormskirk Gas Company, in place of the late Mr. Alty.

Mr. J. Marshall Thomas, the Engineer and Manager of the Penryn Gas Company, was elected an Alderman of that borough at the recent annual meeting of the Town Council.

Mr. Hallewell Rogers has been elected Chairman of the Gas Committee of the Birmingham Corporation in place of Alderman J. H. Lloyd, who, as announced last week, is now Lord Mayor.

Mr. J. Armitage Drake was last Thursday elected unopposed a member of the Corporation of Halifax for the Kingston Ward. It is anticipated that Mr. Drake's experience as a gas engineer will be utilized by placing him upon the Gas Committee, where, judging from remarks made at a meeting addressed by him the following evening, it is much needed.

In consequence of the death of the late Mr. George Glover, Vice-Chairman of the Richmond Gas Stove and Meter Company, Limited, Mr. J. William Glover has accepted a seat on the Board of that Company. The following changes in the Directorate of Messrs. George Glover and Co., Limited, are also announced: Mr. J. William Glover has been appointed Joint Managing-Director of the Company with the Chairman, Mr. E. W. T. Richmond; Mr. Albert W. Glover has been promoted from the position of Works Manager to that of Director; and Mr. William Staples (the inventor of the automatic mechanism of the "George Glover" meter) has joined the Board—his patents, business, and works having been purchased by the Company.

In the "Journal" last week we briefly announced the resignation of Mr. John Marsland of his position of Engineer and Manager of the Sowerby Bridge Gas-Works. During his tenure of this office, the undertaking has advanced very considerably. When Mr. Marsland went to Sowerby Bridge from Newry in January, 1881, the output of gas was only 52 million cubic feet per annum; whereas now it is 116 millions, in addition to the 20 millions produced at the Luddenden Foot works, which came under his supervision twelve years ago. Accompanying the increased business has been a material reduction in the price of gas. Twenty years ago it was 4s. 2d. per 1000 cubic feet in the town, and 5s. in the out-districts. Now the net charges are 2s. 3d. and 3s. respectively.

OBITUARY.

Mr. Solomon Dibbs, the oldest Director of the Sheppey Gas Company, died last Friday week at the age of 88.

The death is announced, at the age of 82, of Mr. T. D. Wivell, the Chairman of the Ilfracombe Gas Company, and for several years Chairman of the old Ilfracombe Local Board.

We regret to announce the death of Mr. John C. Ball, the Parliamentary Agent. He had been in indifferent health for two or three years, and finally succumbed on the 8th inst. The sad event claims notice in our columns from the circumstance that it was through Mr. Ball, in conjunction with Mr. W. A. Valon, that what is known as the "Yeovil clause" became a recognized part of parliamentary practice in connection with the transfer of gas undertakings to local authorities. This clause, it will be remembered, secures to the officers of gas companies recognition of their services by way of compensation to be paid by the purchasing authority, the omission to do which in previous transfers had acted hardly, and in many cases with injustice, on servants of companies who had been compulsorily transferred.

Mr. R. A. F. A. Coyne, who held the post of Superintendent of Works for the Edinburgh and District Water Trust from about the year 1872 to 1897, died in Edinburgh on Friday. He had been in feeble health for several years. Mr. Coyne first served in the Ordnance Survey Department of the Royal Engineers. When he began practice as a Civil Engineer in Edinburgh, more than thirty years ago, he joined in the movement for the transfer of the Water Company's undertaking to the Corporations of Edinburgh, Leith, and Portobello. He subsequently figured prominently in the opposition to the St. Mary's Loch scheme for the augmentation of the water supply. The opposition was successful, and Mr. Coyne shortly afterwards became an official of the Water Trust. He was doggedly devoted to duty, even although it led him, as it often did, into conflict with his employers and other public bodies.

Some of our readers may doubtless remember that, on the occasion of the meeting of the Manchester District Institution at Grantham, in September, Mr. Shadbolt conveyed to the members the heartiest good wishes of his Chairman, Dr. James W. Jeans, J.P., whose advanced age and impaired health prevented him from being present. We regret to learn that Dr. Jeans died at Shanklin last Tuesday evening, in his 89th year. Deceased was practically the founder, and was the only remaining original shareholder, of the Company; and in everything calculated to benefit Grantham he took the deepest interest, though he never aspired to municipal honours. He became a Magistrate as far back as 1859, and regularly occupied his seat on the Bench. Deceased leaves an only daughter. At the Borough Police Court on Wednesday, the Mayor (Mr. H. Hutchinson) referred to the loss the Bench had sustained by the death of its senior Magistrate, and expressed sympathy with the relatives.

Mr. W. J. Kinloch Anderson, J.P., D.L., a member of the Edinburgh Corporation, and Convener of the Works Committee of the Edinburgh and Leith Gas Commissioners, died with startling suddenness in Edinburgh last Thursday. He attended a meeting of the Treasurer's Committee of the Town Council in the forenoon, on quitting which he remarked to a friend that he had not felt so well for a long time. Walking to his business premises in George Street, another friend met him, and observing that he was ill, procured a cab, and drove him to his shop. Mr. Anderson's son resolved to take him home; but on the journey, and when near the Royal Infirmary, such was his father's condition that he directed the driver to proceed there. Mr. Anderson was by that time unconscious, and he died within a few minutes of his admission to the Infirmary. Mr. Anderson had been a member of the Town Council from 1885 onwards. In 1894 he was made a Magistrate; and on retirement from that office, in 1899, he was appointed a Police Court Judge. Almost from the institution of the Gas Commission, in 1888, he was the Convener of the Works Committee; and in that capacity he did much valuable service. In May, 1900, he was laid aside by a severe stroke of paralysis, but recovered so far that he was able to resume his public duties.

Incandescent Lighting by Petroleum.—In the "Journal" for the 5th inst. (p. 1159) reference was made to the Washington system of lighting by petroleum, which is in use on the Northern of France Railway. Owing to the economy realized by this method of illumination, it appears to be displacing electricity in large works. We learn from the "Petroleum Review" that the proprietor of an important chocolate establishment in the Rue de Rivoli has obtained, at a monthly expenditure of 180 frs., the same amount of light which by electricity cost him from 500 frs. to 600 frs. Petroleum incandescent lighting has been adopted in the mines at Marle.

A Smokeless London.—Dealing with this subject in the current number of the "Journal of State Medicine," Sir C. A. Cookson points out that important factors in the production of the smoke nuisance in London are the domestic chimneys, which are not touched by present legislation. For the removal of this cause of trouble, he says there are two conditions which have to be fulfilled by any possible scheme which can be applied within reasonable time—viz. (1) The remedy must be applicable to any open grate; and (2) it must not involve an increase in the cost of the domestic fire. He considers that the claim of gas or electricity to replace coal fires, at any rate in sitting-rooms occupied all day, is at present excluded by the greater costliness of these agents, as well as by the "invincible preference of the Briton for his open grate." He admits that the proposal for cheapening gas by manufacturing it at the pit's mouth is plausible; but the employment of gas as a substitute for coal in domestic fires would, he says, not only involve an enormous outlay in stoves, but also a complete revolution in the coal trade, neither of which consequences would follow the employment of smokeless fuel. The use of this material he therefore regards as the panacea for the smoke evil; and of the two kinds available—anthracite and coke—he considers the latter the more likely material to take the place of coal, inasmuch as its production is not now restricted to gas-works. In his opinion, coke might be sold in London at a price which, compared with that of coal, would very soon exclude the latter from competition.

NOTES.

A Phenomenon of Inverted Flame.

Employing the Teclu apparatus proposed for school demonstration of the reversibility of a flame, some experimenters in the Chemical Institute of the Cagliari University observed a phenomenon which, so far as they are aware, has never before been described. By working carefully in reducing the flow of gas, and compressing the top orifice of the tube within which combustion takes place by means of a bored asbestos disc, a point is attained where the flame has left the air orifice, but not yet occupied that of the gas, and remains between the two tubes, like a dividing plane, tangential to the vertical sections of the orifices. At a rough glance, one can observe in this flame a light blue external margin and a more luminous middle zone. However, by more careful observation, the luminosity of this zone is found not to be equal in the two superficies of the flame. It can also be noted that this results from a combination of the two plane flames—one bluish, and more fully corresponding to the air orifice; the other narrower and more luminous, corresponding to the gas orifice. These two flames are sometimes divided at the apex, and can be clearly distinguished. Thus in one flame there are two simultaneous cumbustions—of gas in air, and air in gas.

Economy of Covering Steam-Pipes.

It is understood by engineers that considerable economy results from the covering of steam-pipes with efficient non-conducting preparations; but it is scarcely realized how seriously the modern practice of working with steam at high pressures heightens this consideration. At a recent test carried out at the generating station of the Isle of Thanet Electric Tramways, 712 square feet of naked piping, containing steam at 364·2° Fahr., condensed 731 lbs. of water per hour, with an atmospheric temperature of 58° Fahr. A naked steam-pipe will therefore condense upwards of 1 lb. of steam per hour for every square foot of its exposed surface. An area of 420 square feet was then covered with fossil meal 2 inches thick, after which the condensation was reduced to 345 lbs. per hour. It seems a pity that the whole of the pipe was not covered, and the actual amount of condensation stated. An important point is very properly made in regard to these tests, of the necessity of covering flanges of steam-pipes. Usually the coating of non-conducting composition is stopped an inch short of the flanges, for good reasons. At the same time, flanges should at least be given the protection of a hinged removable box, as they are as efficient as ribbed pipes in getting rid of heat. This is an excellent piece of counsel. Undoubtedly, any sort of good non-conducting coating for exposed steam vessels will pay for itself; and it is as well for the protection to be thorough at all points.

Inspection of Structural Steel Works.

An instructive lesson upon the care of steel structures is furnished by the report of the New York State Inspectors upon the present condition of the Brooklyn Bridge. It does not seem a long period since this bridge was constructed; but already the breaking of some of the suspenders has led the State authorities to direct a thorough inspection of the work to be made by Mr. Edwin Duryea, who associated with himself Mr. Joseph Mayer, in this arduous task. It was ascertained that, while no serious deterioration of the structure had actually set in, the supervision, inspection, and maintenance have been at fault in not removing various influences which tend in this direction. Two of the suspenders had broken some time before the sudden failure of seven more drew attention to the state of affairs. This shows that the watch kept upon the bridge was not trustworthy. Apart from the particular case of this bridge, regarded as such, this examination demonstrates the necessity of the periodical examination of important steel structures by competent engineers—not workmen regularly employed on the spot—in order to detect such real dangers as rollers set fast, broken pins, and the like. Diagonal rods swaying in the wind are apt to rub against fixed members or start their fastenings. Dust and rubbish may accumulate in pockets and start corrosion. Trunnions intended to be kept lubricated are not lubricated at all. In order to be reliable, inspection of such works should be carried out by responsible engineers, at regular stated intervals, with the results recorded on printed forms provided for the purpose. Then there is a reasonable guarantee that nothing has been overlooked.

Electric Light Rejected for Coal Mines.

It has been declared by Mr. W. H. Halboum in the "Colliery Guardian" that, after many trials and much investigation, electric lighting by incandescent lamps must be definitely ruled out as unsuitable for dangerous coal mines. The improved Davy lamp, with the flame as a source of light, is preferable for the following reasons: The old form of safety lamp was not devised for the purpose of enabling the miner to remain for any length of time with impunity in an explosive atmosphere. In such a lamp, although the flame cannot pass through the gauze and ignite the gas outside, the outer gas can penetrate right into the interior of the lamp and burn within the flame-chamber. This is one of the most valuable features of the Davy lamp. The appearance of the flame in the gaseous atmosphere immediately attracts the miner's attention, and shows him that he has entered a dangerous working, which he had better quit at once and notify to the proper quarter. The electric lamp gives absolutely no indication of the presence of dangerous gases, being completely enclosed and independent of the surrounding atmosphere. It is incapable of setting fire to explosive gases so long as it remains intact; but when broken, it may ignite them without the slightest warning. To meet this objection, many makers of incandescent electric lamps have attached to them fire-damp "indicators," which do away with all advantages claimed for them. Mr. Halboum concludes by stating that every practical pitman at the present day knows that the ordinary type of miner's lamp constitutes a safety lamp chiefly because it betrays the character of the outer atmosphere. If an explosive atmosphere is present, we do not want a lamp that will burn, and a man who will attempt to work, in such an atmosphere. We want a lamp that will give indications of the presence of such an atmosphere, and a man who is not so insane as to attempt to work in an atmosphere which is becoming unfit for respiration.

Action of Water on Lead.

In a recent number of the "Archiv. für Hygiene," Dr. Stanislav Ruzicka gave the results of some investigations he has carried out to ascertain the exact action of water upon lead. On the whole, they tend to confirm those obtained by other investigators; and they are summed up as follows in the current number of the "Journal of State Medicine:" As regards simple solutions of inorganic salts in distilled water, the base of the salt has no influence on the action of the water on lead; but this is determined by the nature of the acid in the salt. The action is increased by the presence of nitrates; while it is diminished by the presence of chlorides, sulphates, and carbonates—the preventive action of the two latter being greater than that of the former. With regard to solutions of salts in combination, an addition of carbonate to the solution of the sulphate, chloride, and nitrate results in a diminution of the action of the water on lead; and the same obtains as regards an addition of the sulphate to the chloride and nitrate, while no change is caused by its addition to the carbonate. Similarly, the addition of the chloride to the solution of sulphate and nitrate also resulted in a diminution of the action; but added to the solution of carbonate, the action is increased if the carbonate is not present in excess. The addition of nitrate to the solutions of carbonate, sulphate, and chloride, always causes an increase in the action. When lead is continually kept in contact with fresh solution of carbonates, the amount of lead in solution decreases; and this is also the case when the solution contains nitrate, provided that the amount of carbonate is kept constant by adding new carbonate. It is also found that free carbonic acid, when present in the solution, greatly diminishes the action on lead, even when the carbonic acid is present in excess. The presence of organic substances does not seem to increase the action on the lead, with the exception of peat, which does so to a slight extent. The most efficacious means of checking the action of water on lead appears to consist in the presence of carbonates and carbonic acid; while the well-known fact that the presence of air in all cases increases the action on lead has been confirmed by the author's experiments.

Among the new knights created on the anniversary of the birthday of His Majesty the King, was Mr. Samuel Butler Provis, C.B., who succeeded Sir Hugh Owen as Permanent Secretary of the Local Government Board.

Among the medals which the President and Council of the Royal Society have adjudicated is a Royal Medal to Professor W. E. Ayrton, F.R.S., for his contributions to electrical science, which the "JOURNAL" has often noticed.

The first course of lectures at the recently opened Petroleum Institute, of which Dr. Dvorkovitz is the Principal, will close on the 20th prox. The second course, which will open on Jan. 29, will include a series on "Illuminants, with Special Reference to Petroleum," by Professor Vivian B. Lewes, F.I.C., F.C.S.

Among the Cantor Lectures to be delivered at the Society of Arts during the session which, as already announced, will open to-morrow evening with an address by Sir William H. Preece, K.C.B., F.R.S., the Chairman of the Council, will be four by Dr. Samuel Rideal, F.I.C., on the "Sterilization of Water." The dates at present arranged for the lectures are Jan. 13, 20, 27, and Feb. 3, 1902.

We are informed that the Board of the Welsbach Company have withdrawn from sale the cheap Sunlight mantles—those which were retailed at 4½d.; but the sale of the Sunlight mantles which are priced at the same figure as the Welsbach is being continued. Of course, the Directors know their own business best; but, from every point of view, it would appear to an outsider that there is a little want of wisdom shown in suppressing this cheap line of mantles. It may be that, in the present circumstances of the Company, they did not find that it paid them to supply, through the Sunlight branch, a low-priced mantle in competition with their own dearer goods. But, since the amalgamation of the two concerns, they have not by any means vigorously pushed this 4½d. mantle to see what could really be done with it. If they had, they would in all probability have worked up a large business in them, and more likely than not have considerably checked the inroads of English-made and imported competitors.

TECHNICAL RECORD.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

A General Meeting of the Association was held last Thursday, at the Holborn Restaurant. The attendance of members was excellent. During the temporary absence of the President (Mr. Corbet Woodall) at the commencement of the meeting, the VICE-PRESIDENT (Mr. W. E. Price, of Hampton Wick) performed the duties of the chair.

The HON. SECRETARY (Mr. James W. Helps, of Croydon) opened the proceedings by remarking that the President wished him to apologize to the members for his absence. He was called away to attend an important meeting of the Board of the Gaslight and Coke Company. He had been present at the Committee meeting during the afternoon; and he hoped to return considerably before the meeting of the members was over. As a matter of course, and at the request of Mr. Woodall, Mr. Price (the Vice-President) would take the chair.

On the suggestion of the HON. SECRETARY, the minutes of the last two meetings were then taken as read.

APPOINTMENT OF OFFICERS.

Mr. HELPS said the next business was the election of officers for the ensuing year. As Mr. Woodall was absent, he had been asked to propose—not in his capacity as Hon. Secretary, but as a Past-President—the new President. The Vice-President was Mr. W. E. Price; and, as a matter of course, he proceeded to the chair. But he (Mr. Helps) did not think it would do to simply allow him to take the presidency of the Association under such a bare condition as that. His name was one that had been long associated with the gas industry; and his father was one of the first members of the Association. Their future President joined it not many years after; and he had on more than one occasion served on the Committee. He had been one of the most regular attendants at their meetings; and he (Mr. Helps) did not think there was anyone in the Association who took a greater interest in its welfare and dignity than Mr. Price. He believed the interests of the Association would not suffer by Mr. Price's promotion; but rather the reverse. Therefore he had pleasure in proposing him as President for next year.

Mr. J. L. CHAPMAN (Harrow), in seconding the motion, bore witness to the interest which Mr. Price took in the work of the Association years ago during the time that he (Mr. Chapman) was Hon. Secretary.

The motion was carried by acclamation.

Mr. PRICE said he was much obliged to the members for having elected him to the presidency during the coming year. He could only promise that he would do his best; but he felt it was rather a serious matter becoming President in succession to the illustrious gentleman who would be vacating the chair after this meeting. But there was one satisfaction in knowing that he had immediately before him a splendid example as a President. He should do his best to copy what Mr. Woodall had done; but he feared it would be only from a great distance.

The CHAIRMAN said the next business was the election of a Vice-President. He had much pleasure in doing this; and he was sure the members would have equal pleasure in hearing the name. The gentleman he proposed was their old friend Mr. J. Tysoe, of East Greenwich. He was a metropolitan member; and they were very pleased to see a metropolitan member as an official of the Association. It was a sight they did not often see.

Mr. F. G. COCKEY (New Swindon) seconded the motion, which was heartily passed.

Mr. TYSOE, in thanking the members, said that, when he was approached on the subject of taking up the Vice-Presidency, he felt very considerable misgivings. That particular office did not cause him any great anxiety; but looking rather to the future, and the future alone, caused him to deliberate seriously as to whether or not he should accept the position. But after giving their Hon. Secretary much trouble, he had accepted the office. He should try to carry out the duties in the best possible manner; and he sincerely thanked the members for their confidence.

Mr. C. F. RUGGLES (Leighton Buzzard) moved, and Mr. F. W. CROSS (Lea Bridge) seconded, the re-election of the Hon. Secretary; both gentlemen remarking upon the valuable services Mr. Helps had rendered to the Association.

The motion was unanimously carried; and Mr. HELPS made appropriate acknowledgment.

On the proposition of Mr. J. LOWE (Weymouth), seconded by Mr. J. DONALDSON (Tonbridge), Mr. H. H. Jones, of Wandsworth, and Mr. S. Carpenter, of Dorking, were elected to fill the places of the members retiring by rotation from the Committee.

On the motion of Mr. T. MAY (Richmond), seconded by Mr. A. F. BROWNE (Vauxhall), Messrs. J. L. Chapman and A. Dougall were re-appointed Auditors.

NEW MEMBERS.

The HON. SECRETARY said he had seven new names to bring before the meeting for election as members. They were: Mr. D. Hunter Anderson, of Caterham; Mr. Percy Siddons Hoyte, of Plymouth; Mr. H. Oswald Carr, of Wandsworth; Mr. W. H. Reed, of Whitchurch; Mr. H. J. Ibbetson, of Newport (I. of W.); Mr. J. Cash, of Brighton; and Mr. T. Glover, of Norwich.

On the motion of Mr. TYSOE, seconded by Mr. ROBERT MORTON, the names were added to the roll of the Association.

THE PAPERS.

The reading of the papers prepared for the meeting was next proceeded with. They will be found, with a report of the discussions, on other pages of this issue.

The first communication was by Mr. C. C. CARPENTER; and it was entitled "Further Experience with Reversible Condensers." In Mr. Carpenter's unavoidable absence in the country on business, it was read by the HON. SECRETARY; the discussion being postponed to the next meeting. The second paper was by Mr. T. RANDOLPH MURRAY (Tottenham); and it was a production covering several points of interest. Its chief purpose was the relation of "Experiences Encountered during Alterations to the Connections of a Water-Gas Relief Holder." The discussion was full, and contained several features claiming attention. Mr. A. W. ONSLOW (Woolwich Arsenal), in the third paper, supplemented his previous contribution on the subject of "High-Pressure Lighting."

At the close of the discussion on the last paper,

The PRESIDENT (Mr. Corbet Woodall), who had returned to the meeting during the discussion on the second paper, proposed that the best thanks of the members be given to the readers of the papers.

Mr. A. F. BROWNE, in seconding, said it had been a matter of great regret to all of them that Mr. Carpenter was unable to be present to read his paper. When Mr. Carpenter told him the previous afternoon that he expected to be called out of London, he (Mr. Browne) experienced a feeling of extreme disappointment; and he thanked the Committee for their suggestion that the discussion upon such a valuable paper should be postponed to the next meeting. With regard to the other papers, the members were greatly indebted to the authors—each of them dealing with matters of considerable interest to the profession, and the discussions had brought out points of importance.

The motion was heartily agreed to.

A NAPHTHALENE INVESTIGATION.

The PRESIDENT next asked the Hon. Secretary to read a report on the question of the appointment of a Sub-Committee to consider and investigate the subject of the formation of naphthalene.

The HON. SECRETARY read the report, in these terms—

Report of Sub-Committee appointed under the following Resolution, passed at a Meeting of the Committee held Oct. 10, 1901.

> That a Sub-Committee be appointed to consider and report in what manner the facilities for investigation possessed by the Association can best be employed to determine questions relating to the formation and deposition of naphthalene.

Since the passing of this resolution, we have met on two occasions, and have given the subject careful consideration.

The question of naphthalene deposits, whether experienced on the works, or in the district, is of very great importance to gas companies, not only on account of the expense and trouble incurred in dealing with such depositions, but also because the inconvenience caused thereby to consumers through the irregularities in their supply, must have a tendency to lead them to forsake gas in favour of some other means of illumination. We therefore believe that it should not be difficult to convince directors of gas companies that it is their duty to provide such funds as will enable our Association to investigate the matter in a more thorough and comprehensive manner than has been previously attempted, and to employ for this purpose the best available professional aid.

We therefore recommend—

> That, as an initial step, a preliminary circular be addressed to all members of the Association asking them to what extent, if any, trouble from naphthalene is experienced; whether they will be prepared to answer further questions, and to give the matter careful consideration; and also whether they would be willing to lay the matter before their directors, and invite them to contribute towards the expenses of investigation.
>
> That, when these replies are received, selections be made of a few works which seem best to lend themselves to further investigation, including among the number works which are free from naphthalene, as well as those troubled by it.
>
> That further inquiries of a more searching character be then addressed to the managers of the selected companies, and that a request be made to them for permission to carry out at their works any series of experiments which the Committee may deem desirable.
>
> That at this stage a thoroughly qualified expert chemist be employed to carry out the necessary investigations both in the laboratory, and (if desirable) the selected works, and to draw up a report on the result of his labours.

We also suggest that steps be taken to collect and arrange, in suitable book form, all the available information and accounts of research work done in connection with this subject.

The PRESIDENT said the Committee had had this question of naphthalene brought home to them very strongly by several circumstances during recent months. Of course, naphthalene was, he would not say a dear old friend, but an acquaintance of long standing; and the question was of as much difficulty, as well as of as much anxiety and importance to-day as it was thirty years ago. Many men engaged in the profession had thought from time to time they had found the absolute cause and remedy; but the discussion that had taken place that afternoon was very

good evidence of the reality of the trouble, and of the necessity of dealing with it. The Committee decided to appoint a Sub-Committee to prepare a scheme of investigation; and the report of the Committee had been read. It would be noticed that it was determined to make inquiries at a number of works within the scope of the Association, and that the inquiry was not to be confined to works where the naphthalene trouble had been experienced, but it was to be extended to some of those where nothing was known of it. It had been suggested that possibly the result of experiments at these works might have the effect of bringing home to the managers who had hitherto had no experienee of the troubles attaching to their neighbours what those troubles were (laughter); but they would try to avoid any such issue as that. The question, however, was one very well worth thorough and complete investigation; and he entirely agreed with the opinion expressed in the report that there ought to be no difficulty in making it clear to directors of gas companies that it was to their interest, and it was their duty, to make possible such an investigation as the one proposed by subscribing the necessary funds. He thought that in England they did less than they ought to do as companies in that direction. In France and in America funds were provided by gas companies for investigations of this sort with a freedom that put our own companies to shame. He thought that what it was necessary for them to do was to bring home to gas companies the need (most of them were quite alive to that), and also the fact that the Association were going to deal with the matter thoroughly and searchingly, and then he thought there would be no difficulty in providing funds. It had been suggested that possibly the Association was a little one, and that it might be well to extend the field from which the Committee would be recruited, so as to take in others outside. It was true they were a small Society; but that was one recommendation for keeping the work to themselves. They could work very well together; and they had within their scope works enough for any such experiments as were proposed. At the same time, he was certain any information that those outside their pale had would be cordially put at the disposal of the Committee. He would ask for observations on the part of the members, and then submit a resolution. He had omitted to particularize one suggestion in the report, that the question had become of greater importance now that gas companies were face to face with real and active competition. There was no doubt that many people, having experienced the annoyance of having their lights extinguished or practically so, and then rectified, and after a fortnight or so finding the trouble return, would be much influenced in determining whether or not they would continue to take their light from the gas companies.

Mr. T. May (Richmond) remarked that they were much indebted to the Committee for having taken up this work. It was unquestionably a very important one; and if they could see their way to carrying out experiments with the view of discovering the cause of, and the means of preventing, these deposits going on, they would earn the gratitude not only of the members, but of the whole gas fraternity. He certainly thought it was desirable that the investigation should be allowed to proceed in the way proposed; and he would be very happy indeed to support anything the Committee did.

Mr. S. W. Durkin (Southampton) also cordially supported the report. Anything, he said, that could be done to ameliorate the conditions of things in regard to this question would be of great good. He presumed that the scope of the inquiry would embrace any means that had been brought to their notice as to the practicability of removing this terror from their daily lives. His idea was that the matter really required dealing with on the gas-works. Although there were means used now to prevent inconvenience out-of-doors, yet the great thing was to take the naphthalene out on the works before the gas was distributed in the district.

The President then moved—"That the report of the Committee be adopted, and that they be empowered to proceed on the lines suggested, and to incur the necessary expenditure."

Mr. Tysoe, in seconding the motion, said he should be pleased to place his work at the disposal of the Committee. He had suffered from the nuisance considerably; and they had ascribed it to the want of sufficient condensation. If they had not sufficient power to remove the naphthalene at the condensers, it went forward, and deposited.

Mr. C. E. Botley (Hastings) also offered to afford the Committee every facility for investigation at his works. He had suffered in years gone by very considerably, particularly outside the works, and to a small extent on the works. At the present time, he was happy to say, they had combated the difficulty; and they had experienced no further trouble either inside or outside the works.

The resolution was unanimously carried.

This concluded the business; but before the members separated, high tea was served in an adjoining room.

Among the Aldermen of Huddersfield whose term of office expired at the close of the past municipal year was Alderman Stocks, the Chairman of the Gas Committee, whose name has lately come rather prominently forward in connection with the investigation into certain matters in his department. Mr. Stocks decided that he would not seek re-election.

FURTHER EXPERIENCE WITH REVERSIBLE CONDENSERS.

By Charles Carpenter.

[A Paper read before the Southern District Association of Gas Engineers and Managers, Nov. 14.]

Six years ago, I had the honour of bringing before the notice of this Association a suggestion for the removal of the surplus naphthalene contained in crude coal gas by means of a reversible condenser in which the deposit of naphthalene thrown down upon the water-cooled walls was dissolved by the hot tarry vapours of the foul-main gas, and run off through suitable seals into the tar-well. The condenser with which the experiment was carried out was an old one, dating probably from the erection of the Bankside works in 1840 (the curious may see it figured in Mr. Colyer's book on "Gas-Works Construction"); and it was an interesting example of the pains taken in those days by engineers to combine the beautiful with the useful. It possessed, however, two qualifications for the trial which were considered important—*i.e.*, it was vertical, and water cooled. In order to effect the reversing of the current of the gas, and make this flow from left to right or right to left as desired, a special four-way valve was fitted up, and connections led therefrom to the extremities of the condenser in the manner shown diagrammatically on the drawings which accompanied the paper referred to.*

Up to the time of the alterations, naphthalene had been an unmitigated nuisance. Such considerable deposits (sometimes several inches in thickness) were formed at times as to throw 5 feet to 6 feet back-pressure on the plant; and with some of the connections it was one of the regular duties to clear these out, at least every fortnight—during the Sunday stop. At other times, the condensers would not pass gas at all, and had to be steamed out. From all these troubles, however, immediate relief was afforded within a few days of the reversible arrangement being started to work, although difficulties arose in endeavouring to get sufficient water through the cooling tubes to reduce the temperature as low as was required. In other words, the apparatus was too small for the work; and persistent efforts to overcome this, by substituting a pump for the water supply tanks, resulted in the collapse, or rather the bursting, of several internal tubes.

It was therefore determined to design a new condenser having a capacity of 2 million cubic feet per diem, the construction of which should be adapted, as far as possible, to meet the conditions of working which experience with the adapted one led us to expect.

As a preliminary, the calculations shown on Table A were made from data obtained during the trials. It was decided to adhere to the use of water as the cooling medium, in order to render the reduction of temperature as far as possible independent of atmospheric conditions. The vertical type was also adopted as a result of the satisfactory working of the experimental apparatus, the facility which the vertical walls afforded for the "buttery" naphthalene to slide down to the seal pots, and the further advantage that the drainage of these more or less liquid products was independent of the direction in which the gas was flowing in the apparatus. Calculations of the duty required of the new plant are given in Table B, and were based upon the results obtained during the tests referred to.

The following is a description of the apparatus (p. 1308): It consists of two rows of seven steel pipes, 27 feet long, formed into a horseshoe by a bridge-piece connection at one end. Within each of these pipes are sixteen 2-inch tubes, running from top to bottom, screwed into the bottom diaphragm separating the water and gas spaces. The expansion of these tubes under the extremes of temperature worked is about $\frac{1}{4}$ inch, and the top ends therefore, after reduction in size to save friction and also to distribute the flow of water, work through stuffing-boxes carried in the upper diaphragm. The working gas-valves consist of two pairs of ordinary slide-valves, each pair geared together—one open one shut—by means of a shaft which carries two pinions operating the racks of the valve in opposite directions. Two pairs of water-valves are also provided; but these work independently. Each pair of the vertical condensing-pipes drains into a double seal-pot of special form, as shown on the drawing.

The consistency of the dissolved naphthalene is such that, in order to maintain it sufficiently fluid, hot liquor must be continually running through the pipe which forms the centre of the seal; and this precaution has been found essential even during the heat of summer. Valves are provided to each seal so as to give access thereto in case of stoppage; the condenser being worked under pressure on the exhauster outlet.

The condenser was put to work early in the summer of the present year; and since this time hardly a flake of naphthalene crystal has been seen on the works or the outlet main. The meter overflow, which used to choke every few days, has remained clear, and so on throughout the plant.

A great many experiments have been made with a modification of Küster's test as first suggested by Dr. H. G. Colman, in order to estimate the amount of naphthalene actually removed by the condenser. But none of these tests have been satisfactory, owing to the disturbing influence of the hydrocarbons and the impurities

* See "Journal," Vol. LXVI., p. 1026.

contained in the crude gas. Tests have, however, been made upon the finished gas at the outlet of the station meter, with results showing from 1½ up to 3¼ grains of naphthalene in 100 cubic feet of gas. Side by side with these figures, I should like to draw your attention to the very remarkable ones shown on Table C. This table has been compiled from figures furnished from the Vauxhall works of the South Metropolitan Gas Company, and gives the amount of clean, deposited naphthalene crystals actually sold, after removal from the mains which carry the purified gas from Vauxhall to the station meters at Kennington. A considerable quantity was also found on the works; but this was too dirty to sell, and the weights therefore were not recorded.

I compare the figures just given with those of the Bankside tests, and where naphthalene has disappeared from the works and the working-up main; and I think I am justified in affirming that evidence has been adduced of the accuracy of the suggestions which I made to this Association in 1895 as to the cause and remedy of naphthalene deposits. These were, you will remember: (1) That, under modern conditions of manufacture, coal gas was produced supersaturated with naphthalene. (2) That its removal could be economically effected by washing down the deposited crystals with gas charged with hot tarry vapours in an apparatus such as I have described. Circumstances have prevented our experiments being carried to the extreme limit desirable; but the proper working temperature of the condenser would appear to be the lowest to which the gas is exposed in its distribution to the consumers.

Gas can then be supplied wholly free from naphthalene; and this is the direction in which our efforts are being directed. Fortunately, we now have a freer hand in this matter than we had twelve months ago, as Parliament has since then removed the vexatious and antiquated restriction as to quality which a 16-candle standard entailed. We are now working down to a 14-candle limit, which will allow a less restricted use of the condenser and give greater permanence to the character of the gas we distribute to our customers.

My thanks are due to Mr. A. F. Browne for the interest he has taken in, and the supervision given to, the preparation of the materials for Tables A and B by Messrs. R. Collins and B. Browne.

TABLE A.—*Bankside Experimental Condenser.*

Data.

Gas temperature	Inlet, 144° Fahr.
,, ,,	Outlet, 82° ,,
Circulating water temperature	Inlet, 76° ,,
,, ,, ,,	Outlet, 88° ,,
Gas passing (measured at 60° Fahr. when purified)	40,000 c. ft. per hour.
Water passing	300 ,, ,,
Tar thrown down	1 gallon per 10,000 c.ft.
Number of legs in condenser	16

Required to find proportion of work done in the condenser by the water and also by the air, separately.

Analysis of the Calculation (in Briti sh Thermal Units).

HEAT UNITS GIVEN UP BY THE GAS.

Constituent.	Weight in Pounds.	Fall of Temperature. Deg. Fahr.	Specific Heat (Water as Standard).	Heat Units. (B.T.U.)
Mixture known as "Purified Coal Gas"	1,443·36	62	·762	68,190
CS_2	2·33	62	·157	22
SH_2	44·86	62	·243	676
CO_2	72·15	62	·216	966
NH_3	14·92	62	·508	470
Tar	48·68	21·1 (calculated average)	·288	296
Aqueous vapour in form of saturated steam	431·38	31·5 (calculated average)	·305	4,147
Latent heat of aqueous vapour.	(Quantity of aqueous vapour deposited, 359·30 lbs.)	..	..	370,022
Total	2,057·68	..	..	444,790

HEAT UNITS ABSORBED BY THE COOLING WATER.

Constituent.	Weight in Pounds.	Rise of Temperature. Deg. Fahr.	Specific Heat.	Heat Units. (B.T.U.)
Water	18,720·00	12	1·0016	225,000

Heat units given up by the gas . . . . 444,790 = { Work to be done by cooling agents.

Heat units absorbed by the water . . . 225,000 = { 50·5 per cent. of the work.

Summary.

Work done by the circulating water . . . = 50·5 per cent.
Consequently, work done by the atmosphere = 49·5 ,,

TABLE B.—*Bankside Multitubular Condenser.*

Data.

Average gas temperature	Inlet, 134·3° Fahr.
,, ,, ,,	Outlet, 61·3° ,,
Average temperature of circulating water	Inlet. 59·3° ,,
,, ,, ,, ,, ,,	Outlet, 92·5° ,,
Gas passing (measured at 60° Fahr. when purified)	35,800 c. ft. per hour.
Water passing	833 gallons ,, ,,
Tar thrown down (estimated)	1 gallon per 10,000 c.ft.
Number of legs in condenser	14

Required to find the proportion of work done in condenser by the water, and also by the air, separately.

Analysis of the Calculation (in British Thermal Units).

HEAT UNITS GIVEN UP BY THE GAS.

Constituent.	Weight in Pounds.	Fall of Temperature. Degs. Fahr.	Specific Heat (Water as Standard).	Heat Units. (B. T. U.)
Mixture known as "Purified Coal Gas."	1291·60	73	·762	71,846
CS_2	2·09	73	·157	24
SH_2	40·15	73	·243	712
CO_2	64·57	73	·216	1018
NH_3	13·14	73	·508	487
Tar	42·04	19·2 (calculated average)	·288	232
Aqueous vapour in form of saturated steam	299·80	25·8 (calculated average)	·305	2359
Latent heat of aqueous vapour	(Quantity of aqueous vapour deposited, 267·80 lbs.)			278,145
Total	1753·39	—	—	354,823

HEAT UNITS ABSORBED BY THE COOLING WATER.

Constituent.	Weight in Pounds.	Rise of Temperature. Degs. Fahr.	Specific Heat.	Heat Units. (B. T. U.).
Water	8330·00	33·2	1·0015	276,900

Heat units given up by the gas . . . . 354,823 = { Work done by cooling agents.

Heat units absorbed by the water . . . 276,900 = { 78·0 per cent. of the work.

Summary.

Work done by the circulating water . . . = 78 per cent.
Consequently work done by the atmosphere. = 22 ,, ,,

TABLE C.—*Statement of Gas Made and Naphthalene Sold (Vauxhall Station, S.M.G.C.)*

Year.	Gas Made at 30" Bar. and 60° Fahr.	Quantity Sold.			Grains per 100 Cubic Feet.
	(Thousands).	Tons.	Cwt.	Qrs.	
1890	1,558,123	21	0	0	21
1891	1,597,129	19	10	0	19
1892	1,644,676	34	1	3	32
1893	1,783,131	30	18	0	27
1894	2,040,322	43	18	0	33
1895	2,167,839	49	8	0	35
1896	2,280,970	50	6	0	34
1897	2,395,300	61	9	0	40
1898	2,514,323	77	15	3	48
1899	2,528,344	90	11	0	56
1900	2,644,143	107	4	3	63

APPENDIX.

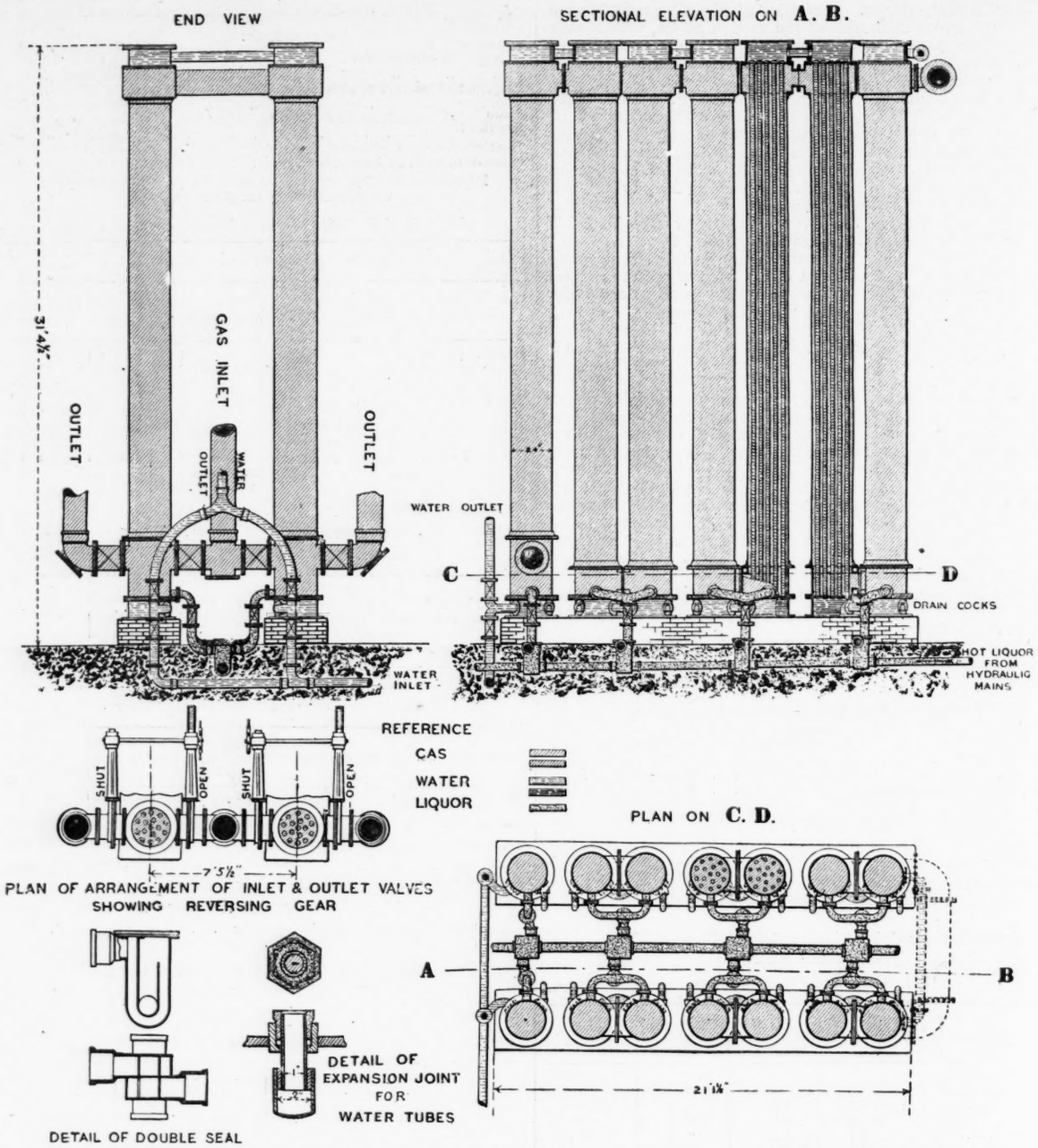
CALCULATIONS OF THE APPROXIMATE DUTY REQUIRED OF THE BANKSIDE REVERSING CONDENSER IN COOLING FROM 140° TO 60° FAHR. A VOLUME OF GAS MEASURING 2,000,000 CUBIC FEET AT 30" BAR. AND 60° FAHR. WHEN SATURATED WITH AQUEOUS VAPOUR.

Data Required for the Calculation.

1.—An analysis of London coal gas.
2.—Specific gravities of its constituents at 30" and 60° and at 30" and 140°; air = 1.
3.—Specific heats of its constituents at constant pressure, water = 1.

Authorities Consulted.—Professor Lewes; Ganot's "Physics;" Deschanel's "Heat;" D. K. Clark's Table No. 130, p. 396; Tables in "Gas World Year Book;" and Butterfield's "Chemistry of Gas Manufacture."

(1) The analysis of London coal gas selected is one by Professor Lewes.
(2) *Its specific gravity at* 30" and 60°.—This has been arrived at by multiplying the volumes per cent. of the various constituents found by Professor Lewes into their respective specific gravities, and taking their sum as the mean specific gravity of the mixture = ·373, air = 1. From this figure the specific gravity at 30" and 140° (the assumed temperature at the inlet of such condenser at Vauxhall) has been calculated = ·3233.



MULTITUBULAR WATER CONDENSERS—TWO MILLION CUBIC FEET PER DIEM—AT THE BANKSIDE GAS-WORKS.

(3) *Its Specific Heat.*—This has been similarly calculated—viz., by multiplying the weights per cent. of the various constituents found by Professor Lewes into their specific heats at constant pressure, and taking their sum as representing the mean specific heat of the mixture = ·743, water = 1.

(4) *As regards Aqueous Vapour.*—To obtain its weight, the gas has been assumed to be saturated both in the condenser and in its passage through the station meter. This assumption has since been confirmed by experiments made at Vauxhall. Its volume at 60° Fahr. and at 140° Fahr. has been calculated from its vapour tension at each of those temperatures, by the formula—

$$V_1 = V_2 \times \frac{(30'' + t)}{30''}$$

Where V_1 = volume of saturated gases at a particular temperature; V_2 = volume of dry gases at the same temperature; t = tension of aqueous vapour in inches of mercury at the particular temperature. Hence 2,022,466 cubic feet (of dry gas + impurities) at 60° Fahr. will become at 140° Fahr. 2,332,900 cubic feet.

To find the total volume at 140° Fahr.

The volume of dry gas and impurities at 140° Fahr. and 30″ pressure is 2,332,900 cubic feet, as above. And the tension of aqueous vapour at 140° Fahr. is 5·8578 inches of mercury. Therefore, by the formula $V_1 = V_2 \frac{(30'' + t)}{30''}$, the total volume of mixed gas and impurities and water vapour will be 2,788,400 cubic feet. Therefore the volume of aqueous vapour at 140° Fahr is 2,788,400 − 2,332,900 = 455,500 cubic feet.

(5) *The Impurities.*—The volumes of these have been added, being the results of experiments at Vauxhall; also a proportional quantity of water vapour, since these impurities afford additional space for its diffusion.

To Find the Weight of Aqueous Vapour Present.

The total volume of mixed gases and vapour at a given temperature being known, the weight of the aqueous vapour can be ascertained direct from D. K. Clark's table of saturated air.

(6) *As regards Cyanogen.*—Its volume at the outlet of the condensers has been assumed from Butterfield's "Chemistry of Gas Manufacture." Its specific heat cannot be found in tables; and the figure adopted is assumed from its density, which is between those of carbon dioxide and sulphur.

CALCULATION OF VOLUME OCCUPIED BY THE CRUDE GAS ENTERING THE CONDENSER.

The 2,000,000 cubic feet at station meter is assumed to be saturated at 60° Fahr.

(1) *To Find the Volume of Dry Gas Present at 60° Fahr.*

This is calculated from the foregoing formula

$$V_1 = V_2 \times \frac{(30'' + t)}{30''}$$

$$\text{Therefore } V_2 = V_1 \times \frac{30''}{(30'' + t)}$$

Where V_2 = volume required; V_1 = 2,000,000 cubic feet; t = 0·52047 inch of mercury. Therefore V_2 = 1,965,800 cubic feet.

(2). *To Find the Volume of Dry Gases Present at 140° Fahr.*

A gas expands $\frac{1}{491}$rd of its volume at 32° Fahr. for a rise of 1° Fahr.

Estimation of Heat to be Removed from 2,000,000 Cubic Feet of Purified Gas in Condensing from 140° to 60° Fahr.

Gases or Vapours.	Volume at 60° Fahr. and 30 in. Bar. Cubic Feet.	Volume at 140° Fahr. and 30 in. Bar. Cubic Feet.	Specific Gravity at 60° Fahr.	Specific Gravity at 140° Fahr.	Weight of Gases or Vapours. Pounds.	Specific Heats.	B.T. Units to be Removed.	Remarks.
Purified gas, dry	1,965,800	2,267,600	·373	0·3233	56,160	·743	3,338,000	
CO_2 (impurities to be added) .	24,200	27,916	1·529	..	2,834	·216	48,970	
NH_3 ,, ,, ,, .	16,000	18,457	·589	..	722	·508	29,300	
H_2S ,, ,, ,, .	14,400	16,611	1·191	..	1,313	·243	25,520	
CN ,, ,, ,, .	1,500	1,730	1·796	..	206	·209	3,440	
CS_2 ,, ,, ,, .	566	653	2·64	..	114	·157	1,430	
Aqueous vapour (in above) . .	35,180	455,500	·082 lb. per 100 ft. of saturated gases at 60° Fahr.	·806 lb. per 100 ft. of saturated gases at 140° Fahr.	22,474	·305	274,200	In cooling 40° Fahr.†
					20,787	1044·4*	21,710,000	In condensing at 100° Fahr.
Total.	2,057,646	2,788,467	..	..	..	..	25,430,860	

* Latent heat at 100° Fahr. = assumed mean temperature of condensation. † *i.e.*, from 140° to 100° Fahr.

Hence 1 cubic foot of gas at 60° Fahr. will become at 140° Fahr. $1 \times \frac{(461 + 140)}{(461 + 60)} = 1{\cdot}1535$ cubic feet.

Calculations Affecting Duty and Efficiency.

Theoretical Flow of Heat Required.—From the table it can be seen that the work required of the condenser is to transmit 25,430,860 B.T.U. from the gas to the water every 24 hours. This is at the rate of 1,059,619 B.T.U. per hour, or 310 B.T.U. per square foot of condensing surface per hour. The total condensing surface on the water side is 3418 square feet.

Data for Calculation.

Conduction of Heat through Metals (*D. K. Clark, pp.* 459, 461).

The flow of heat which traverses an element of a body in a unit of time is proportional to (1) its surface, (2) the difference of temperature of the two faces perpendicular to the flow, (3) and inversely proportional to the thickness of the elements. It also depends on (*a*) the material, (*b*) the condition of the surfaces, and (*c*) the substances in contact with the plate. It is therefore necessary to find some results of experiments on the conductivity of the metal of the 2-inch pipes (mild steel) which will guide us in estimating the mean rate of flow of heat in the condenser.

The nearest approach to the conditions existing in the condenser was found in D. K. Clark, p. 470—viz., hot water circulating in cast-iron pipes 2½ inches in internal diameter, ¼ inch thick, and cooled by still air round the outside of these pipes. The condition of these pipes was rusty. In this case the rate of conduction of heat was found to be 1·82 B.T.U. per square foot per hour per degree difference of temperature. The conductivity of mild steel is not widely different from that of cast iron

From statement (3) we see that, by substituting ⅛-inch for ¼-inch pipes, the rate of conduction is doubled, and hence becomes 3·64 B.T.U. per square foot per hour per degree difference of temperature. The circulation of the gas will again alter this result. (See D. K. Clark, p. 461). It is assumed that the effect will be to increase the rate of conduction to 7·2 B.T.U. per square foot per hour per degree difference of temperature : since Clark infers that circulating air will enable the heat to be passed twice as quickly as still air. This is probably due to the fact that a greater difference of temperature is maintained.

Estimated Maximum Rate of Conduction of Heat.—Assuming the water to be raised 17° Fahr. in its passage through the condenser, the inlet gas at 140° Fahr. is met by the outlet water at 60 + 17 = 77° Fahr. Maximum difference of temperature = 140 − 77 = 63° Fahr. ; maximum rate of conduction of heat = 63 × 7·2 = *453 B.T.U. per square foot of condensing surface per hour.*

Estimated Minimum Rate of Conduction of Heat.—Assuming the gas at its outlet to be 10° Fahr. above the inlet water in temperature, we have : Minimum rate of conduction of heat = 7·2 × 10 = *72 B.T.U. per square foot of condensing surface per hour.*

Estimated Mean Rate of Conduction of Heat.—The probable mean rate of conduction of heat in the condenser from the gas to the water is about the mean of 453 × 72 B.T.U. per square foot per hour, or about *250 B.T.U. per square foot of condensing surface per hour.*

Water Flow Required in Condenser (Theoretical).—Heat to be removed = 1,059,619 B.T.U. per hour. This quantity is sufficient to raise $\frac{1,059,619}{T}$ lbs. of water T° Fahr. per hour. Therefore the quantity of water required = $\frac{1,059,619}{T}$ lbs. per hour or $\frac{105,962}{T}$ gallons per hour, where T = rise in temperature of cooling water.

At the close of the reading of the paper,

Mr. Helps said he felt inclined to suggest that the discussion on the paper should be postponed to the next meeting. Mr. Carpenter greatly regretted that, at the last moment, he could not be present; and he wrote suggesting that the paper should not be taken at all. However, the paper having been prepared, he (Mr. Helps) thought it a pity it should not be read; but still he considered the best thing under the circumstances would be to postpone the discussion. At the next meeting they would have nothing but the presidential address; and it would be an easy matter for them to meet half-an-hour earlier in order to take up the discussion. But if any member had questions to ask regarding the apparatus, Mr. Carpenter's assistant (Mr. Franks) would be glad to explain any point.

The Chairman (Mr. W. E. Price) said that if Mr. Franks would kindly explain the diagram so that the members might know more about how the apparatus worked, they would be in a better position to consider the paper before the next meeting.

Mr. Charles Franks (Bankside) said that the condensers were composed of fourteen steel tubes, as already described in the paper, erected in two rows of seven each, each tube containing fourteen 2-inch ordinary gas-barrel pipes, through which the cooling water flowed, the gas passing outside them. The gas-inlets to the condensers faced each other at the bottom of the two first legs; the outlets being also on the two first legs looking outwards.

Mr. T. May (Richmond) asked the size of the steel tubes.

Mr. Franks : 24 inches. The gas was allowed to enter either side of the condensers according to the direction in which it was desired to work, by means of the inlet-valves shown on the end elevation drawing of the condensers, and then took an up-and-down course, passing up the first leg to the top, where the leg was connected to the second one, down this one, up the next, and so on, ultimately reaching the bottom of the last one in the second row immediately opposite where it entered, and left by the outlet-valves shown. When they had been worked in one direction for a week, the valves were reversed, and the gas flowed in the opposite direction. The hot gas coming in contact with the naphthalene deposited on what was the previous week the coolest legs, causing it to travel down to the bottom, where it ran off through the branch pipes and seals put there for the purpose. The cooling water entered at the gas-outlet end of the condensers, travelling the reverse way to the gas; its direction being reversed when required by the valves shown. The seals which prevented any gas short-circuiting by means of the condensed products pipe, were provided with a clear-way through the centre, through which the hot liquor from the hydraulic mains passed and kept them warm, and thus prevented them blocking. The drawing also showed the stuffing-box used at the top end of the 2-inch tubes, each of which was fitted with a piece of 1-inch pipe turned on the outside.

The Chairman remarked that the discussion on the paper would be postponed until the next meeting. He hoped that in the meantime members would consider the paper in connection with the question of naphthalene. It was a trouble that they always had with them, and were likely to have in the immediate future. However, he hoped the paper would be of help in the effort to arrive at a solution of the difficulty.

Mr. A. F. Browne (Vauxhall) remarked that Mr. Carpenter had kindly acknowledged their assistance from the Vauxhall station in regard to the compilation of the table appearing in the appendix. Within the last day or two, they had found an error in the table which would alter the total number of units by some 5 millions. They had now got a more accurate calculation of the amount of heat units present in the gas; and he would hand the corrected figures to the Press.*

Messrs. Alder and Mackay's "Slot Meter" Contribution to the War Fund.—Those of our readers who visited the Glasgow Exhibition will in all probability remember that Messrs. Alder and Mackay, of Edinburgh, had on view, at their stall in the Heating and Lighting Section, some penny-in-the-slot gas-meters, which could be witnessed in operation by the insertion of a coin. It was announced that the proceeds of this novel form of collection would be sent to the "Daily Telegraph" and "Scotsman" Widows' and Orphans' Fund, started in consequence of the war in South Africa; and during the period of the Exhibition it was the means of furnishing a by no means insignificant contribution to this deserving fund. The amount remitted by Messrs. Alder and Mackay up to the 9th inst. was £117 16s. 4d.—the total product of the meter collection; but they actually received £122 2s., so that there is a small balance still to hand over. The curiosity of the public to see instruments at work is well known; and it is pleasing to be able to record that its gratification has, in this case, served a purpose alike patriotic and philanthropic.

* We give these remarks by Mr. Browne in order to call the attention of members who may have the paper in its original form to the modification in the figures. But both the appendix and the table as given in our report have been revised by Mr. Browne, and may be taken as correct.

EXPERIENCES ENCOUNTERED DURING THE EMPTYING AND ALTERATIONS TO CONNECTIONS OF A WATER-GAS RELIEF HOLDER AND TANK.

By T. Randolph Murray, of Tottenham.

[A Paper read before the Southern District Association of Gas Engineers and Managers, Nov. 14.]

Though opportunities for periodically examining the interiors of both large and small gasholders frequently occur, yet the following account of the emptying of the 80-feet diameter relief holder and tank, and of the subsequent alterations and enlargements made to the connections of the same may not be without interest to the members of the Association.

The holder in question has been in constant use at the Tottenham works for upwards of 40 years, and since the year 1894 as a water-gas relief holder. It has a capacity of 180,000 cubic feet, in two lifts, being provided with a guide-framing of the cast-iron column type, and calls for no particular description with regard to details of construction. The object in view when the emptying and cleansing were determined upon was the enlargement of the existing 12-inch inlet and outlet connections, which had become too small for the volume of gas passed through the holder—some 2 million cubic feet per diem. This resulted in a heavy back-pressure being thrown on the generating plant, which became a matter for serious consideration, owing to recent extensions in that quarter.

The above-mentioned 12-inch connections were put in when the holder was first erected at these works; and their inadequacy to deal with the water-gas passed through the holder when it was finally put to this use, points to the disadvantage of employing existing small holders as water-gas relief holders, unless the connections thereto are of adequate diameter, or steps have been taken to make them so.

It was decided in this case to replace the existing inlet and outlet connections with a 36-inch inlet, and a 24-inch outlet main respectively. It had been estimated that these would provide ample carrying capacity for any increased volume of gas which it might be necessary to deal with, in the event of the generating plant being still further augmented at some future date. The considerably greater diameter afforded to the inlet as compared with that of the outlet main, was to enable it to cope with the intermittent rushes of warm gas coming over from the water-gas plant, and, by its ample capacity, prevent the possibility of any back-pressure.

Before proceeding to describe the ensuing operations, it must be preliminarily mentioned that the holder-tank had been made temporary use of as a storage tank for water-gas tar; and there was some 4 feet depth of this product contained at the bottom when emptying operations were commenced.

The first operation carried out was the pumping off of the tank water overlying this tar; and it had to be accomplished while the inner lift of the holder was kept afloat and in use, as long as it was possible to do so. This was done in order to avoid shutting down the water-gas plant until the last moment, as it could not well be spared at the time. The suction-pipe from the pump was inserted in the annular space between the inner and outer lifts; and it was found that the water came over comparatively pure at first, and was run away down the surface drain without our encountering any trouble from the Local Authorities. As soon, however, as the cup of the floating inner lift began to settle into the tar, the pump began to lose the water and draw on the tar. The water still remaining within the tank was dammed up there by the embedded lift, and further pumping operations in that direction were found to be impossible.

Attention was then turned to clearing the tank of tar; and for this purpose one of the Drum Engineering Company's rotary pumps was pressed into service, and was found to answer exceedingly well. The suction was in this case lowered down nearly to the bottom between the outer lift and the wall of the tank. The tar when pumped was rather more difficult to dispose of, and an attempt was made to get rid of it by loading it into barges at the Company's oil delivery wharf, situated on the Lea Navigation Canal, about a mile distant. In order to do this, it was decided to empty of "dead" oil the 2½-inch pipe-line running between the wharf and the oil-storage tanks at the works, and, by making a short connection from the holder tank thereto, utilizing this delivery for loading the barges down at the wharf.

The preliminary emptying of the pipe-line was successfully effected in a somewhat novel manner. The suction end at the wharf was allowed to dip into the river; the pump at that point was then set going; and the water so pumped was allowed to force the oil in the pipe-line back to the storage tanks on the works—careful watch being kept to see that pumping operations at the wharf should cease at the critical moment, and that no water should be pumped into the tanks. The reverse of this process had, of course, to be carried out with regard to the removal of the water pumped into the pipe; the water-gas tar in this case being allowed to act as the clearing agent, and the water discharging back again into the river.

The arrangement described was found to work well as far as the delivery of the tar at the wharf was concerned; but after one or two consignments had been disposed of in that manner, we began to encounter trouble with our purchasers, owing to the percentage of water in each delivery proving abnormally high. This was no doubt due to the fact of the tar and water having been stored together in the manner described. It was also found that at one stage of the pumping operations, owing to the lifts of the holder being slightly tilted out of the horizontal plane—due to a reason not then apparent, but which was discovered later—the tank water dammed up within the inner lift was evidently making its way through the tar, and under the cup and bottom curb of the respective lifts, at the point where they were tilted highest, thus finding an outlet into the annular space between the outer lift and the tank wall, and mixing in a very large proportion with the tar lifted by the pump.

That means of disposal had, therefore, to be abandoned, and recourse had to the coal stacks as receptacles for what still remained at the bottom of the tank. Previous experiments at Tottenham in this method of utilizing water-gas tar, have proved that a very substantial increase of illuminating power, and an increased make per ton, are undoubtedly to be obtained by the admixture.

The appended table, which has been compiled from statistics covering two consecutive periods of sixty-five working days each, shows at a glance the increase of illuminating power and make to be obtained.

Averages of Results of the two Consecutive Periods of Sixty-five Working Days each.

Tar Used Per Ton of Coal Carbonized. Gallons.	Make of Gas Per Ton.	Average Illuminating Power. Sperm Candles.	Gallons of Tar Used Per 1000 Cubic Feet of Gas Made.
5·15	11,093	15·13	0·46
Nil	10,758	14·35	
Increase . . .	335	0·78	——

Or an increase of about 1·69 candles per gallon of water-gas tar used per 1000 cubic feet of gas made.

This high gas enrichment value to be obtained from the tar when so utilized, is, it would seem, sufficient to warrant its regular disposal in that manner. There is, however, one considerable drawback—namely, the objectionableness of the resultant mixture, which has a strong tendency to adhere to the stoking tools, not to mention the garments of the stokers. It was in fact chiefly this objection that led to the discontinuing of the practice at Tottenham, after a protracted and otherwise satisfactory trial. Since, however, the adoption of power stoking machinery at the above works, the objection just cited is largely done away with; and the sticky nature of the tar makes it a valuable agent for laying the coal dust, which, with power charging machinery fed with broken coal, is excessive, and is apt to become a source of considerable trouble. Moreover, the original price of a 1¼d. per gallon for water-gas tar is no longer obtainable; so that with tar at a selling price of only ¾d. per gallon, and the above advantages enumerated, it would seem that its re-adoption as an enriching agent was becoming worthy of consideration.

The coal dust annoyance above alluded to has no doubt manifested itself from time to time to engineers who have power charging machinery in operation on their respective works. Stopped ascension-pipes, arch-pipes, and even clogged hydraulic mains, are probably more largely due to this source than is generally credited, where such machines are employed. We use at Tottenham the Arrol-Foulis stoking-machinery. The small charges of coal dropping from the charging-machine in front of the pushing device has the effect of raising a violent dust in the retort; and the conclusion I have come to is that the larger portion of the dust is carried up the ascension-pipes, and tends to largely produce stoppages. The admixture, therefore (when available), of water-gas tar with the coal, as a means of combating this trouble, while at the same time benefiting both the make per ton and the illuminating power of the gas, may be commended to their consideration.

While the emptying of the holder-tank was in progress, a problem for careful consideration presented itself—namely, the clearing or scavenging out of the "dead" gas contained in the inner lift of the holder, which would be fully charged therewith, owing to its having been kept afloat and in use during the tank emptying operations, as was previously described.

Among the adjacent buildings surrounding the relief holder, were a boiler-house and retort-house, both of which were within a radius of a few yards, not to mention the Cambridge main line of the Great Eastern Railway, which ran by upon the east side, equally close. Great care had, therefore, to be exercised in this part of the undertaking to prevent the possibility of any ignition of the issuing gas and air, which would manifestly be of a highly explosive nature.

The method determined upon for the discharging of the contained gas was as follows: The bonnet of the valve for closing the outlet main from the holder, which valve was situated at a point in the main beyond the water-gas exhausting plant, was to be removed and the valve disc pulled out. A long rectangular wooden shaft, previously prepared for the purpose and constructed to fit the rectangular top of the valve, was to be erected over the mouth of the aperture, to serve as a discharging shaft for conveying the gases well above the roofs of the surrounding buildings. The manhole in the crown of the holder was then to be removed, a long

canvas tube (of the same diameter as the manhole aperture, and provided at its upper and lower extremities, and at intermediate points, with circular distending rings) was then to be lowered down, the tube being of such a length that the lower end reached to within a foot or so of the few inches of tar still remaining at the bottom of the tank. The ring forming the upper extremity of the tube was to rest round the exterior margin of the manhole; being made slightly larger for the purpose. This orifice was then to be covered with a sheet of fine wire gauze, as a protection—on the Davy lamp principle—against a possible falling spark; the whole being well pugged down round the edges to the crown sheeting with some soft clay puddle. The upper orifice of the wooden discharge shaft on the outlet-main was to be similarly protected.

The water-gas exhausters, situated between the holder and the discharge shaft as before described, were then to be run; drawing in air at the manhole in the holder crown. This air would then find its way down the canvas tube to the surface of the tar, and, being of a higher specific gravity than the gas, would drive it upwards, piston fashion; the gas being in the meantime drawn off at the outlet pipe beneath the crown. This outlet was conveniently situated diametrically opposite to the manhole; thus minimizing the possibility of the air making a short circuit through the gas.

To Mr. A. E. Broadberry, the Company's Engineer, is mainly due this ingenious device, which was adopted to prevent as far as possible the formation of an explosive mixture within the holder; and as was afterwards proved, by tests on samples of the issuing gas collected at the top of the outlet shaft, its action was as nearly as possible perfect.

As the pumping operations drew near completion, all preparations were made for as speedily as possible carrying out the final cleansing operation; and as the last tar that it was possible for the pump to lift was pumped on a Saturday, it was decided to clear the holder of gas on the following Monday. At this stage, however, we nearly encountered disaster. The Saturday night proved an unusually cold one for the time of the year; and Mr. Broadberry, on going round the works in the course of the evening, discovered that the crown and side sheeting of the holder were dangerously bulging inwards, and to such an extent as to throw into sharp relief the lines of the crown trusses, and the side stays within. He at once procured a handy spanner and slacked out the holding-down bolts of the manhole cover in the crown, allowing the air to rush in and compensate for the contraction of the gas that had taken place.

This had occurred so rapidly that the ¾-inch vent cock on the centre of the crown had proved inadequate to maintain equilibrium. The rapid cooling of the gas within the holder was all the more remarkable as the temperature of the gas taken at the top of the discharge shaft later on during the process of emptying the holder, proved it to be distinctly above atmospheric temperature and quite warm to the hand. On the following morning, it was decided, in view of the events of the previous evening, not to further delay operations, but to commence at once the emptying of the holder, as the air that it had been necessary to admit into the interior had probably formed a more or less explosive mixture with the gas.

With the aid of two men who happened to be at work, the canvas tube was got into position, covered with the wire gauze, and sealed down with clay as previously described. It was found impossible, with the time and help available, to get the wooden discharge shaft into position on the top of the valve on the outlet main; so the bonnet having been removed, a short length of 18-inch steel blast-pipe was placed vertically over it, and made tight round the bottom with clay puddle. The exhausters were then started and an estimation made, from their delivering capacity per hour, as to what length of time would be theoretically necessary for them to effect a displacement of the gas in the holder. This was found to be about 2¼ hours.

The first sample of gas, which was taken after a lapse of fifteen minutes exhausting, was collected in an aspirator close above the wire gauze covering the orifice of the discharge-pipe. When ignited, it burnt with a perfectly luminous flame. This was followed at intervals of fifteen minutes by similar tests. Nor was there much depreciation noticeable until the final test, the gas for which was collected at the expiration of the time determined by the calculation. This burnt with a distinctly non-luminous flame, and required some pressure exerted on the aspirator to keep the flame from flashing-back and igniting the whole sample; thus betraying the undoubted presence of an explosive mixture at this stage.

The final sample, taken after the lapse of a further 15 minutes, failed to ignite, showing that the scavenging operation was complete. The exhausters, however, were kept running for a further period of five hours, to ensure a thorough ventilation of the interior of the holder and tank. Had it been known beforehand that the success of the scavenging operation was so assured, the "dead" gas within the relief holder would have been transferred to another holder, instead of being discharged into the atmosphere; periodical tests being made to determine the critical point at which the discharge should be diverted from the receiving holder to the atmosphere. A considerable volume of practically pure gas would have been recovered in this manner.

It had been observed for some time past that the lifts of this holder remained somewhat tilted when grounded on the rest-stones, and the origin of the displacement had hitherto remained a mystery. A curious discovery was made relating to this, on entering the interior of the shell for inspection, on the following Monday, when it was found that a surface-water drain discharged into the tank on the side adjacent to the retort-house. This drain had been connected, at some forgotten period, with the fall pipes from the gutters of the roofs of the retort-house and coal-stores. The rainfall of years had washed down the fine coal dust and silt from the roofs to such an extent as to silt up that side of the tank sufficiently to throw the lifts appreciably out of the horizontal plane, as was before mentioned. The practice of turning surface-water drains into gasholder tanks must therefore be condemned in the light of this experience.

The alterations to the inlet and outlet connections of the holder were in due course successfully carried out; a heading being driven through, beneath the dry well and the bottom of the tank, to facilitate the removal of the existing connections and the erection of the enlarged ones. This heading was afterwards filled solid with clay puddle.

In addition to the gas inlet and outlet pipes, provision was made for pumping off any tar that may in the future accumulate in the bottom of the tank. This took the form of a 6-inch cast-iron suction, carried down the well and beneath the side of the tank, terminating a few inches above the bottom of the interior. Further provision was also made for pumping off the residual oil that from time to time collects upon the surface of the tank water, and which in the ordinary way is inaccessible. This took the form of two 2-inch wrought-iron suction pipes, carried down and under the bottom of the tank in the manner described for the tar suction, but being extended up within the interior of the tank until they terminated 5 inches and 10 inches below the overflow level respectively; the object being to utilize the longer of the two pipes to skim a comparatively thin layer of oil off the surface of the tank water, while the shorter would afford a means of pumping off a deeper accumulation. The differential lengths of the pipes also provides a means of gauging, to some extent, the depth of the condensed oil upon the surface of the tank water.

After the alterations to the holder connections, &c., had been completed, it was found necessary, owing to the need of further storage room, to put the inner lift of the holder to work, while there was as then only some 7 feet of water in the tank. This meant the displacement of a large volume of air before the lift could be charged with gas. The same device which had been employed so successfully during the emptying operations was again brought into use; the operation this time being reversed, and the air in the lift being expelled by the inflowing gas at the orifice of the canvas tube, which was lowered, as before, through the manhole in the crown.

Tests were periodically made on samples of the issuing air; and these were collected in the aspirator at the mouth of the manhole. Until the close of the operation, these samples, when tested, indicated the presence of a very small proportion of water gas, and quite failed to ignite; while samples taken at the vent cock on the centre of the crown burned brightly from the commencement of the operation, proving that the stratification of the air and gas was maintained to a remarkable degree. This was further demonstrated in rather a striking manner on pulling up the canvas tube towards the close of the operation, when it was found that some 2 feet of the outer surface from the bottom end upwards was comparatively clean and white; while the remainder was stained with a brownish deposit of heavy oil vapours from the gas, which had leaked through the texture of the canvas—this being no doubt the origin of the gas found in the earlier samples. The demarcation between the zones of stained and unstained tube was sufficiently pronounced to corroborate what had been previously indicated by the tests—namely, the comparative absence of diffusion between the strata of air and gas.

Discussion.

The CHAIRMAN (Mr. W. E. Price) said this was an interesting paper, and dealt with a circumstance which did not fall to all of them—at any rate, not often. The condition of a gasholder after being in use for an indefinite number of years was interesting. The method of getting rid of the gas, and thus avoiding that unpleasant period—the explosion period—was very capably dealt with, and lucidly explained, in the paper. The method, too, of driving the air out of the holder when the alterations were finished was also interesting. Perhaps he might say that he had himself, a little time ago, had to do the same thing in the case of a new holder; and there the method of putting a pipe down to the bottom (it was not, however, a canvas pipe), just to the surface of the water, was adopted. It was undoubtedly the right thing to do. Perhaps Mr. Murray would be able to tell them whether, after the air had been blown out, the gas became reasonably illuminating. He (Mr. Price) had found that for some time it still continued—instead of improving as he hoped it would—to show a low illuminating test. In his own case, the amount blown out of the crown of the holder on the same method as described by Mr. Murray was considerably more than the capacity of the crown; and since that time the holder had been raised over five sheets, had been worked out (not blown away), and had been refilled. This had, in fact, been done three times, and yet the gas was not so good by some 2 or 3 candles as the make. This was, he thought, an indication that some absorption was going on inside the holder—absorption by the water. The water, of course—the tank being a new one—was clean. He should like to hear the experience of any of the members on this point. He was at first somewhat puzzled as to the amount of change that

had taken place in the gas in this particular holder, which before its entrance was far better than the poor illuminating power indicated after storage.

Mr. J. TYSOE (East Greenwich) said, with regard to emptying air out of holders, he had had some experience; and the last was in connection with the large holder at East Greenwich. In that case, they adopted a similar method to the one described, with the exception that, instead of using canvas tubing, they employed light metal tubes. Probably canvas tubes would be a preferable way of dealing with the matter; but, in his case, they thought it better to adopt light wrought-iron tubes suspended from holes in the crown. The crown being 300 feet in diameter, they introduced three such tubes in the area, passing them down to about 2 feet of the surface of the water. When the whole thing was finished, these tubes were allowed to drop into the tank; and precautions were taken to prevent them floating about anywhere. They were secured; and there they remained, in the same position so far as he knew, to the present day. With regard to blowing out the air, Mr. Price had mentioned a difficulty that he had had. He (Mr. Tysoe) might say that they had a very similar difficulty. The large amount of gas that it was necessary to put into the holder before they got gas of sufficient illuminating power for the district was very surprising. They made tests through an aspirator. It was not advisable to put a light to a tube direct from the holder, in case of an explosive mixture, which might have blown it up. They took every precaution, and thought they had got the whole of the air out. According to the appearance of the gas burnt at the outlet of the aspirator, they believed it was all right; and the gas was turned out into the district, with, he was sorry to add, unpleasant results. But he was glad to say the test for that particular day had been already made—anyway, judging from the return they had the next day, he assumed the test had been taken either before or after this gas was sent out. However, they escaped a penalty, although he could see himself, by the lights in the district, that something had gone wrong; but possibly he was the only one who knew what the trouble actually was. With regard to mixing tar with coal, he was surprised to hear the results obtained. He had himself made some attempts in that direction, but with very indifferent results. The results were such indeed that he had not cared to repeat the experiment. He did not know whether Mr. Murray had found any difference in the coke that was withdrawn after the coal had been treated with the tar; but he himself found that the difference was quite sufficient to prevent any further extension of experiment in that direction.

Mr. HELPS: Yours was coal-gas tar, not water-gas tar.

Mr. TYSOE said his was coal-gas tar; and possibly that might account for it. He had for the moment forgotten that it was water-gas tar that was operated upon at Tottenham. Still he should like to know whether any difference was noticeable in the coke. Respecting the dust arising from charging retorts by machinery, Mr. Murray suggested that this might possibly find its way up the ascension-pipes, and cause trouble; but he (Mr. Tysoe) thought that was hardly likely. In his own case, they used machinery very largely. Clouds of dust did arise at every drop of the charge of coal in the Arrol-Foulis machines; but he could not conceive, unless the hydraulic main was empty and the exhauster was drawing on the ascension-pipe, that any of that dust would go up the ascension-pipe. On the contrary, when a retort was charged, it was usual to see clouds of dust coming from the mouthpiece until such time as the door was closed. This fact, he thought, was sufficient to show there could not be any possibility of coal dust going up the ascension-pipes in the manner suggested. The paper was an interesting one; and the thanks of the members were due to Mr. Murray for the pains he had taken in laying the facts and points before them.

Mr. F. W. CROSS (Lea Bridge): May I ask Mr. Tysoe whether it was fresh water in the tank when he found a reduction in the quality of the gas?

Mr. TYSOE: Fresh water.

Mr. C. S. ELLERY (Bath) said he had scarcely thought, from the title of the paper, that they were going to hear about the method of mixing tar with coal, which some of them had talked about, and had been laughed at for speaking about, years ago. It might interest the reader of the paper and perhaps some others present to know that he had been guilty of the "folly" of using tar in this way, and that after having been working with it now for some five, six, or seven years. He was particularly interested in seeing the figures in the paper, although he was bound to say that of late years he had not taken the trouble to work out his own figures to the second place of decimals, as the author had done. But other reasons had borne with them at Bath. One was that it was not easy to get rid of the water-gas tar at first; and they were driven to do something. They had previously been using coal tar. He did not quite catch whether Mr. Tysoe said it had spoilt his coke; but their experience was the exact reverse. The coke coming from the retorts fed with coal treated with tar was decidedly better. It was cleaner, and was a coke which would sell readily. They found, when it was put on the market, it was appreciated more than a coke from coal which had not been treated with tar. He quite agreed with the suggestion as to the advantage of laying the dust from the small coal. It had a further advantage with small coal—that was, in altering the condition in which the coal lay in the retorts. Instead of being a dead, dense mass, which took a considerable time to burn off, by treating it with tar, the coal did not lay so closely together. They could easily see that this was so, as it would burn off in less time, and much more completely. He also agreed with the writer of the paper as to the increased yield of gas per ton of coal. But there was this to be borne in mind by those who might be using the figures in the paper, that, although this quantity of tar was added to the coal put into the retorts, he did not imagine Mr. Murray suggested that the whole of it was converted into gas.

Mr. A. E. BROADBERRY (Tottenham): There is a mistake in the figures. The tar used per ton of coal carbonized should be 5·15 gallons, not 51·5 gallons as shown in the paper.*

Mr. ELLERY said that even then a considerable quantity of this tar, he believed, found its way back again into the mains, or some of it at any rate. He did not suppose it was all converted into gas. Some of it was converted into coke.

Mr. MAY: Can you tell us Mr. Ellery how you mix your tar with the coal?

Mr. ELLERY replied that he used stoking machinery. The coal was raised to the hoppers by an elevator, composed of buckets, and as each bucket tipped its coal into the hoppers the falling coal touched a tapping-valve, which liberated a given quantity of tar, which tar mixed with the coal in the hopper in as nearly a uniform manner as possible. He wished someone would devise a method of using more tar, because he believed, with the inferior coal now used, the employment of tar must become more extended. He could not help wondering, in connection with the holder referred to, why their friends at Tottenham did not connect their gas to both pipes—that was to say, use both the inlet and outlet pipes as inlet-pipes, so as to avoid the necessity of putting in a larger pipe. Then where the inlet and outlet pipes were quite close together, and the time came when the outlet-pipe was not sufficiently large for the district, the inlet-pipe could be used as well. There was only one other point, and that was as to the water in the tar. To him it was a very puzzling question how it varied from time to time as it did; and if any member had had experience in lessening the percentage of water in the tar, he should be personally obliged to know how it was done, and he had no doubt the information would be useful to others—that was to say, how it was to be lessened where it reached the abnormal figure of 8 or 9 per cent. They knew, for example, that something had been done in the way of filtering. Where the percentage of water was somewhat high, difficulty was experienced; and if the writer of the paper could give them a suggestion for dealing with that large percentage, he should be grateful.

Mr. J. W. HELPS (Croydon) said he had only one remark to make; and he should not have made that if Mr. Ellery had not, in the latter portion of his speech, asked for information as to anything that was being done in regard to getting rid of the large percentage of water out of tar. He should like to mention that a gentleman named Davies, of the Hydroleum Company (which had been formed for exploiting a system of burning liquid fuel), had lately devised what had turned out to be a very successful arrangement. Its great charm lay in its simplicity. He had been making experiments with it in Croydon, in connection with a tar-burner. One of the difficulties he experienced was in the large quantity of water in the tar, and a large quantity sometimes of a curious fluffy matter, which practically had no burning properties. Mr. Davies had devised a means whereby he had a screen—a very fine mesh screen; he (Mr. Helps) believed it was something like 50 or 60 to the inch—and he found that by inclining this screen at a certain angle—an angle varying according to the consistency of the tar—the water and this curious fluffy material of which he had spoken rolled right off, and the tar, freed practically from the water, fell into a tank beneath. It was simple; and Mr. Davies said his experience was that just as oil would find its way through a joint or hole that water would not, so the tar would go through this fine mesh and the water and fluffy material would not.

Mr. S. W. DURKIN (Southampton): Is that carburetted water-gas tar or ordinary coal-gas tar?

Mr. HELPS: I am speaking of carburetted water-gas tar.

Mr. BROADBERRY said, in taking part in the discussion, he did not want in any way to trespass on Mr. Murray's prerogative in answering the various questions; but one or two points had been raised upon which he might be permitted to offer a few remarks. First with regard to the point as to the inlet and outlet pipes of the gasholder being put in independently, and not bound up together, the reason was chiefly that they desired (it was a water-gas relief holder) the gas to pass through the holder, because it acted as a mixing chamber in the first place, a condensing surface in the second, and it was a convenient place for depositing the unfixed oil which must necessarily deposit somewhere from time to time. Sometimes it was deposited, and at other times it was most mysteriously taken up by the gas and disappeared. As to the quantity of water-gas tar mixed with the coal, he had already mentioned to Mr. Ellery (as he thought it might possibly have affected his argument) that there was a mistake in the table. Instead of being 51·5 gallons of tar mixed with each ton of coal, it was only 5·15 gallons, which made a considerable difference.* Then as to the point Mr. Tysoe had alluded to, regarding the coal dust. Mr. Tysoe said he did not think it was possible for this dust to be carried up into the hydraulic main. He (Mr. Broadberry) not long since had some pitch taken out of the hydraulic main and washed by bisulphide of carbon; and he found that just about 60 per cent. of the pitch was insoluble by bisulphide of

* The correction referred to has since been made.—ED. J.G.L.

carbon. He thought that it must have been composed of solid particles of coal dust. As to Mr. Price's remarks about finding that the gas in his holder had not been relieved of the last trace of air, it would be remembered that Mr. Murray said that, in the case mentioned in the paper, they put gas into the holder when there was only about 7 feet of water in the tank; so that there was a large space inside the holder. He (Mr Broadberry) thought that in all probability what air was left in the gas was down in the bottom of the tank over the surface of the water, and the gas going in and out practically took a short cut—into the inlet and out of the outlet pipe; and consequently they did not notice that the air that was left in the holder was actually coming off a little at a time. Probably Mr. Price had his tank filled quite up with water; and whatever air was left in there would have a perfectly easy opportunity of getting out of the outlet-pipe. This would explain the difference in the experience at the two places.

Mr. Cross said he thought that, if a certain amount of oil were placed on the top of the water in the gasholder tank, the difficulty of the absorption of the illuminating properties of the gas by the water would be overcome, because he took it that this was where the illuminating power went to. If a certain amount of oil were allowed to float on the top of the water, they would preserve a great many of the illuminating qualities of the gas. The same thing, he believed, had occurred in Mr. Broadberry's case—immediately he put the carburetted water gas into the holder, there was a film of oil deposited over the water in the tank. This was one reason why he thought Mr. Broadberry did not lose any of his illuminating power. He quite agreed with Mr. Broadberry in not concurring with Mr. Ellery in using the two pipes as an inlet for the water-gas holder. A relief holder acted as a condenser and as a mixer. It was of particular use as a mixer of the gases; but as a condenser for the last traces of oily vapour, it was invaluable. They heard of some gas engineers speaking of getting oil in their purifiers; but if they looked after the relief holder a little bit more, they would leave the oil behind.

The President (Mr. Corbet Woodall), who had just previously returned, said, before calling upon Mr. Murray to reply, he had to express his regret that he had not had an opportunity of reading the paper or hearing it read; and therefore he could not speak with regard to it. He did, however, take exception to Mr. Broadberry's expression with regard to the oil which was necessarily found in the relief holder. That there would be some was, he (the President) thought, no doubt necessary; but that there should be anything like the quantity that was often found in the relief holders connected with water-gas plant, he altogether denied. He thought that, in this respect, they had failed rather in providing adequate condensing power; and that was the direction in which water-gas plants would be improved, and ought to be improved, in the near future. There was one nice little episode (that he hoped might be regarded as apposite to the discussion) which had taken place, and which had come to his knowledge recently in the case of a company, of which unfortunately they had no representative as a member of the Association. The difficulty was found in connection with a very large holder, which was used to receive both coal gas and the water gas made on the works. Both streams were taken into this one holder and mixed. After some time it was found that the holder was not settling level on the rest-stones at the bottom; and, upon examination, it was further found that the cause of this was an accumulation of naphthalene, so solid that it could only be removed by pick-axes in very small quantities. To him (the President) the experience was entirely new, and he thought it was probably new to most of the members of the Association. But he was curious to know whether any gentleman who had to deal with carburetted water gas largely had had any similar experience with regard to relief holders. What apparently happened there was this: Naphthalene was formed in the ordinary way, and not he thought in very excessive quantity. But the water gas carried forward a certain quantity of oily matter. This mixed with the naphthalene; and so long as it remained mixed, the probability was the naphthalene to a very large extent floated. But in the hot weather the oily matters were evaporated; and then the naphthalene, with the heavier portion of the oil, sank to the bottom, and then, because of its character, formed into this remarkable hard and compact substance. It filled up the space between the rest-blocks, and piled up to such an extent that, as he had said, the holder was put so much out of the level that there was danger it would become permanently distorted. However, he believed they would be able to deal with the matter. He thought it was an incident of sufficient interest to those who were using water gas in conjunction with coal gas to cause them, when they had the opportunity, to give an eye to the condition of the tanks of their holders. Very shortly afterwards he had the opportunity of examining a tank of a holder which had been used simply for coal gas; and he found there was a considerable accumulation of dirty naphthalene at the bottom of the tank. This was again a little surprise to him, because he had never before met with it—probably through not searching for it; but it was not in this case in the hard condition found in the other one.

Mr. Murray, in reply, said the President and Mr. Broadberry had dealt with most of the points that had been raised in succession; and there was very little further that he need say. There was one point in connection with Mr. Tysoe's remarks. He had tried to show that their theory was wrong with regard to the stoppage of ascension-pipes. Of course, they all knew that when the door of a retort was closed, there must be an up-current of gas to the ascension-pipe; and consequently if there was any dust floating about in the mouthpiece, it would naturally be carried up. As to Mr. Ellery's question regarding the water in the water-gas tar, so far as he (Mr. Murray) could make out, there did not seem to be much remedy for it, unless they had some mechanical arrangement such as Mr. Helps had spoken of. The specific gravity of the water and the tar were about the same. Their water-gas tar had an average specific gravity of about 1·064; and it did not separate out at all readily—it took some time to do it. With reference to Mr. Price's remarks regarding the loss of illuminating power when he was filling the crown of his holder, what, in their own case they were most struck by was the fact that, when they took samples from the vent-cock in the centre of the crown, right away from the beginning they had gas of high illuminating power. It did not seem to be vitiated by the air present. Then they were also struck by the marking on the outer surface of the canvas tube. They could see where the strata of the gas had travelled down the side of the tube, and it had terminated just at the point where they pulled the tube up. They were not curious enough to follow it up any farther than that. They simply left the layer of air at the bottom of the holder, and thought it would not matter much, as it would be gradually absorbed by the gas present.

HIGH-POWER GAS-ENGINES.

At the Meeting of the Glasgow and West of Scotland Technical College Scientific Society last Saturday, Mr. A. Rollason, of Nottingham, submitted a paper on "High-Power Gas-Engines and the Conditions Necessary for their Successful Working."

The author began by pointing out that the working capabilities of gas-engines have considerably increased in recent years, so that motors of more than 100-horse power are now quite common and in daily use, running satisfactorily and comparing favourably in economy with the highest class of steam-engines. He went on to say that in this country, the largest engines which have been at work for any length of time indicate about 600-horse power. On the Continent, however, sizes up to 1200-horse power are at work, and giving fairly good results. There are, both in this country and on the Continent, fifteen well-known firms making engines of over 250 indicated horse power.

The development of these large powers has not been attained without considerable difficulties having to be overcome; but these having been surmounted, and the conditions understood, there is only the thickness of the cylinder walls, which limits the quantity of heat passing through the metal to the water-jacket, to control the size of the cylinder. Multiple cylinders, however, can be used to give any desired power.

All the high-power engines, with one exception, work on the "Otto" cycle; and all with two exceptions retain the hot products of the previous explosion which are left in the clearance space or combustion chamber—these products mixing with the new explosive charge taken into the cylinder on the suction stroke. In the exceptions referred to, while the "Otto" cycle has been retained, a pump has been added to positively displace and clear out these products. There are thus two distinct types of engines for comparison—scavenger and non-scavenger.

As early as the year 1860, the late Sir William Siemens described and claimed the process of scavenging by passing a current of air through the working cylinder of a gas-engine at the completion of the effective stroke. Since then many inventors have attempted to solve this problem; but it was not until the year 1892, at the Crystal Palace Electrical Exhibition, that an engine with a simple and effective scavenging arrangement was first shown working.

The author expressed the opinion that, from an economical standpoint, all large engines should be constructed to work with fuel gases, as these usually contain from 56 to 70 per cent. of non-combustible matter. He showed the advantages of scavenging out the burnt products by a comparison of the results obtained in engines actuated by the same gas. At the works of Messrs. Brunner, Mond, and Co., Limited, Northwich, an engine of each of these two types—scavenger and non-scavenger—of the latest design, by different makers, is in daily use; and careful and reliable tests have been made on them to determine their respective capabilities. Both engines are approximately of the same area in feet per stroke, and also in the proportion of the clearance to the stroke.

An indicator card taken from the non-scavenging engine, working on the fuel gas, showed the clearance volume to be 27·12 per cent. of the working stroke; while a card taken from the scavenger engine, working on the same gas, showed the clearance volume to be 27 per cent. of the working stroke. This positive scavenging action clears out the burnt products, and the volume of air which is swept through the cylinder lowers the temperature of the walls, piston, and valves, and prepares them to receive the incoming charge. As there is left in the clearance space a volume of air at a lower temperature, a greater quantity of gas can be taken into the cylinder on the suction stroke, and without increasing the loss to the water-jacket.

The non-scavenging engine may be taken to be the latest and best of its type. With an increase in the ratio of gas to air, the power developed, with 74·25 explosions per minute, was 216·45

indicated horse power; but the gas consumed was 62·74 cubic feet, and the thermal efficiency fell to 28·61 per cent. In a non-scavenging engine we can reduce the clearance with a corresponding amount of residue; but in doing this we increase the compression. For many reasons, in large engines of this type, high compressions are not desirable.

Mr. Rollason gave two tables from the report of the Gas-Engine Research Committee of the Institution of Mechanical Engineers, with indicator diagrams, to show the effect of increasing the compression by reducing the clearance, and of varying the quantity of gas admitted without changing the compression. He then went on to say that all gas-engines run at fixed speeds. Consequently, if the combustible charge admitted to the cylinder when using fuel gas is not of fairly constant composition, the ignition of the charge may be delayed, or it may fail to ignite. When a hot tube is used for the ignition, trouble frequently arises as the composition of the charge varies. The igniting-point being a fixed one, any variation in the heat value will alter the rate of propagation of the flame and the pressures developed in the cylinder. The correct timing of the point of ignition is of great importance in large engines. All carbon gases are slow to ignite; and as in some cases their composition constantly varies—some as much as from 33 to 40 per cent. in heat value—the rate of propagation of the flame in the mass is not constant. The gases used should be clean and free from dust or tarry matters, and of constant composition. Gases containing hydrogen, owing to its greater affinity for the oxygen contained in the charge, are superior for engine use than those where the chief combustible is carbonic oxide, though the heat value of each is practically the same. All large engines using fuel gas should have electric ignition.

Referring to the common practice of comparing gas-engines with those working by steam, Mr. Rollason pointed out that a different set of conditions exists. He explained that a gas-engine is a machine which has to automatically control the amount of combustible matter required to be admitted to its cylinder in proportion to the work given out by its crank-shaft, however variable that work may be, in order to keep the speed constant. Excepting the fly-wheel, there is no reserve of power behind the piston, as in the steam-engine; consequently, unless all parts work in unison, the machine fails to act. In running, if the weight of the charge taken into the cylinder before compression is reduced by heating, and the composition of the gases in the charge varies, the power given off will be greatly lowered, and the engine will work unsatisfactorily, owing to the difficulty in igniting the charge at the correct moment to suit the composition taken in. But if a practically constant gas is used, however low its calorific power may be, the engine can be so adjusted as to give the best results. This was shown by another table and diagrams from the report of the Gas-Engine Research Committee.

In bringing his paper to a close, the author emphasized the fact that, in working large engines, the best all-round results are to be obtained by scavenging out the hot products, combined with the water-jacketing of the piston and exhaust-valve. He pointed out that in the construction of these engines, the best quality of materials should be used, with a liberal allowance in the weight and size of the parts in excess of the calculated strength. The bearings and moving parts should have large surfaces, and the workmanship be of the highest class. In daily operation, care should be taken that a constant supply of cold water, either from a tank or other source, is provided; also that the cylinder jacket does not get overheated, as large engines are liable to be strained by the expansion of the metal should this occur. A small and regular supply of oil is required to be fed to all the moving parts, but only sufficient for lubricating purposes. If too much is fed to the cylinder in non-scavenging engines, the surplus generally carbonizes, and adheres to the back of the piston and exhaust-valve seat, causing loss of power through leakage, and frequent premature ignitions. The arrangement for silencing the exhaust should be of ample capacity to prevent any back-pressure on the engine. If the exhaust is throttled in non-scavenger engines, a greater volume of hot products is left in the clearance space; and there is also a further liability of a portion already expelled being again drawn into the cylinder during the suction stroke. If these conditions are observed, the gas-engine will be found to be as reliable a motor as the steam-engine; it will require no more attention; and it will amply repay the user in fuel economy.

Motors for Blast-Furnace Gases.—A list of large gas-engines, consuming blast-furnace gases, given in an article by Herr Franz Walter in "Das moderne Beleuchtungswesen," contains several which were not referred to in the article on the Oechelhaeuser gas-engine which appeared in last week's "JOURNAL." Among these are two of 300-horse power each, in addition to two of 200-horse power, all on the Otto system, at Friedenshütte. At full load, these consume barely 125 cubic feet of gas per horse-power-hour. Since June, 1900, a 600-horse power single-cylinder engine, made, like the Friedenshütte engines, at the Deutz works, has been in use near Oberhausen, driving an alternating current dynamo. A 600-horse power Otto engine, made by the Berlin-Anhalt Engineering Company, has been running since November, 1899, at Differdingen. Messrs. Körting Bros. have under construction a 500-horse power engine on novel lines; and Messrs. Hartley and Petyt, of Bingley, have constructed a four-stroke engine of 150-horse power for use with blast-furnace gases. Moreover, gas-engines of 1200 to 1500-horse power are now freely spoken of.

NOTES ON HIGH-PRESSURE GAS LIGHTING.

By A. W. ONSLOW, of Woolwich Arsenal.

[**A Paper read before the Southern District Association of Gas Engineers and Managers, Nov. 14.**]

Some twelve months ago, I had the honour of reading a paper before this Association on "High-Pressure Gas Lighting;" and nearly all the figures mentioned therein must remain to this day, so far as my experience goes. Pressure of work has prevented me from completing experiments such as would interest you; so that I must be content with a cursory glance through the principles of lighting that may materially assist many in coming to a definite conclusion as to the most effective systems of lighting by gas.

There are people who are determined not to have gas, if electricity is obtainable; others who have had electric arc lights and wish to change probably a wobbling, erratic system to a permanent one; and those who are halting between two opinions—gas or electric light. And it is to the two latter that this paper is devoted.

In determining the burner, one must, of course, settle the pressure to be given. To obtain 430 candles, it is necessary to increase the pressure in a Welsbach-Kern burner that is made for 10 inches to 22 inches pressure. In assuming the candle power, the writer has taken 31 candles as a fair average. Probably, some will argue that this is not sufficient; others that it is too much, taking the life of a mantle into consideration. But it should be a very equable one; and it is the one upon which all the calculations herein mentioned are based. A new mantle has been said to give 40-candle power per cubic foot of gas; but it is feared a very transient one. Again, 35 candles has been quoted; but if a fair medium is struck, and one that can be maintained, it must of course be regarded as preferable to an exalted but only temporary one.

It might very well be asked, Can a burner and mantle picked from a number of others give nearly 10 candles per cubic foot more than another make that is considered to give perfect combustion? There are burners worse than the 31-candle limit; but are there any better? For this reason, we can obtain, at 54 inches pressure, a burner with nearly perfect combustion, and an average mantle of 31-candle power per cubic foot, with 14 or 15 feet of gas consumption per hour, and an illuminating power of 430 to 460 candles. So that, under these conditions, it is not necessary to go back from 60 inches or thereabouts when already the services to high-pressure is charged to this extent for one at from 10 inches to 25 inches. Certainly we can, and do; for some burners reduce the pressure at the burner itself to that required —say, to 20 inches.

Again, I venture to say, with all due respect to the 10-inch users, that we cannot look for a 1500 to 2000 candle power burner at their pressure. And why look back? Five years ago, we should have been told that it was impossible to produce 450-candle power burners. In five years' time—and I sincerely trust before that period—we shall be able to send out a quotation to burner and mantle makers for 1500-candle power burners, irrespective of pressure; and I am sanguine enough to put this illuminating power at a minimum one. Now, as the lighting effect of a mantle is reduced from 40 to 31 candles, it is only fair to bring the electric arc down to its lighting efficiency; and as it is beyond the limit to obtain more than 2000 candles per unit, whereas 2500 candles is claimed for a unit, the comparison mentioned herein must be based on these figures. It should be our endeavour, I think, to reduce the size of lamps, and the number of burners in them, as much as possible, as it is not everyone who cares for a 40 to 60 inch lamp to be fixed outside, or inside, his premises. Hence the reason for reducing the number of burners. Should we not believe more in the value of ocular demonstration, and avoid elaborate calculations as much as possible, and consider whether a 1400-candle power lamp, placed in a conspicuous position (with the cost for installation, power, and maintenance ready to hand), is the best argument?

Take the following as an illustration in my experience: We have a factory lighted by gas at 54 inches pressure, which had been previously lighted by the ordinary flat-flame burner. About 500 to 600 men work in the building, which is well filled with machinery of all descriptions. Therefore, the very difficult problem arose as to pleasing all parties—every man requiring a light to suit his own particular work (quite a different matter from lighting an open space). The flat-flames numbered 625; consumption of gas, 4375 cubic feet per hour; illuminating power, 7437 candles; and cost of gas, 8s. 9d. per hour—maintenance not calculated or included.

We have now dispensed with all these burners, with the exception of about twenty, and substituted high-pressure gas lighting, to the great satisfaction of all concerned. Fortunately, I had the sympathy of my Superintendent, Colonel M. T. Sale, C.M.G., and of Colonel Watkin, C.B., the Superintendent of the factory concerned, both of whom were prepared to back up any enterprise that enabled me to carry out the work just described. The result is as follows: Number of incandescent burners, 150; consumption of gas per hour, 2250 cubic feet; illuminating power, 64,950 candles; cost for gas, renewals of mantles, power, and every incidental charge, 6s. 10½d. per hour; and the workmen are

THE RETORT-HOUSE AT THE VIENNA NEW GAS-WORKS.

Fig. 3

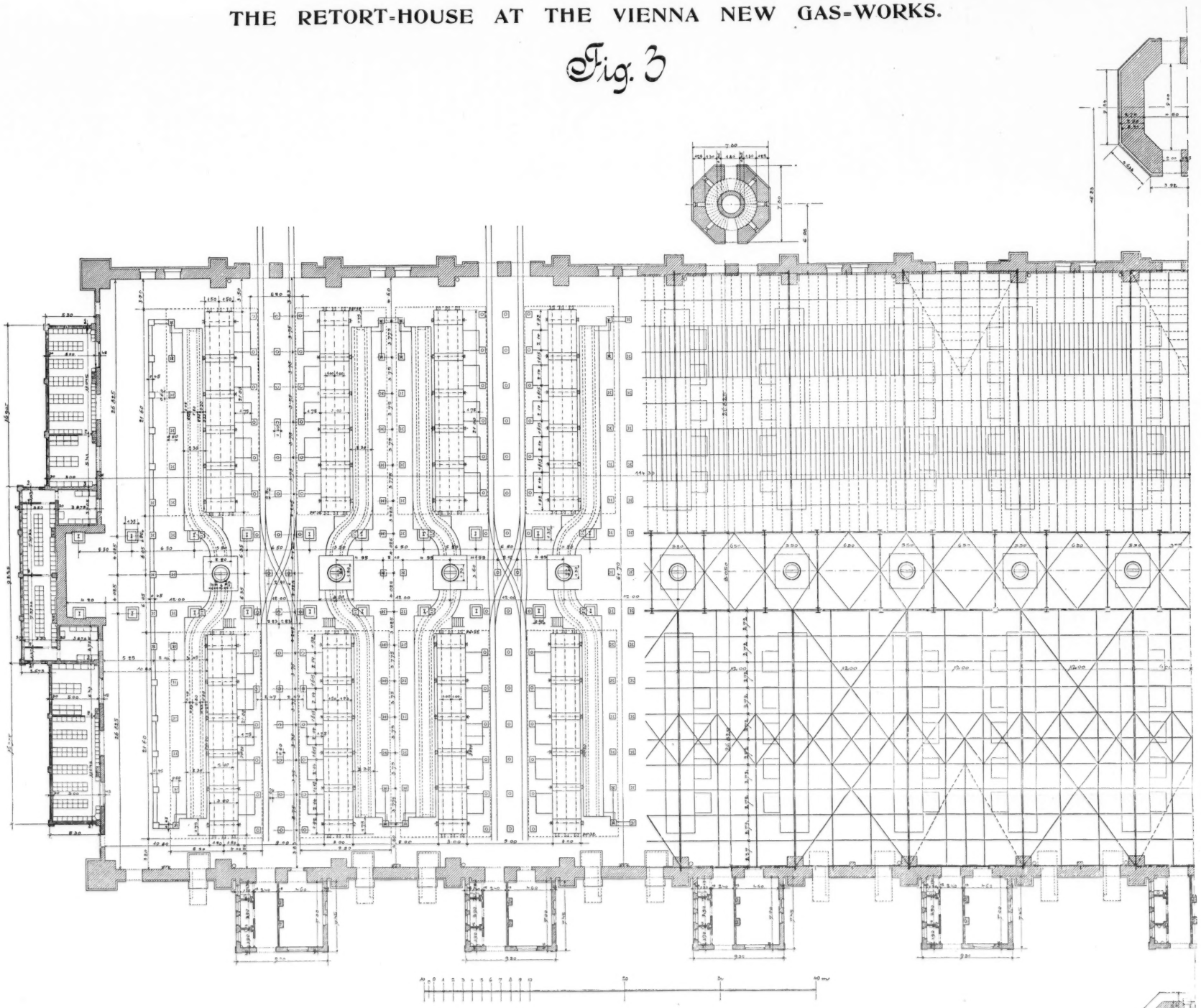
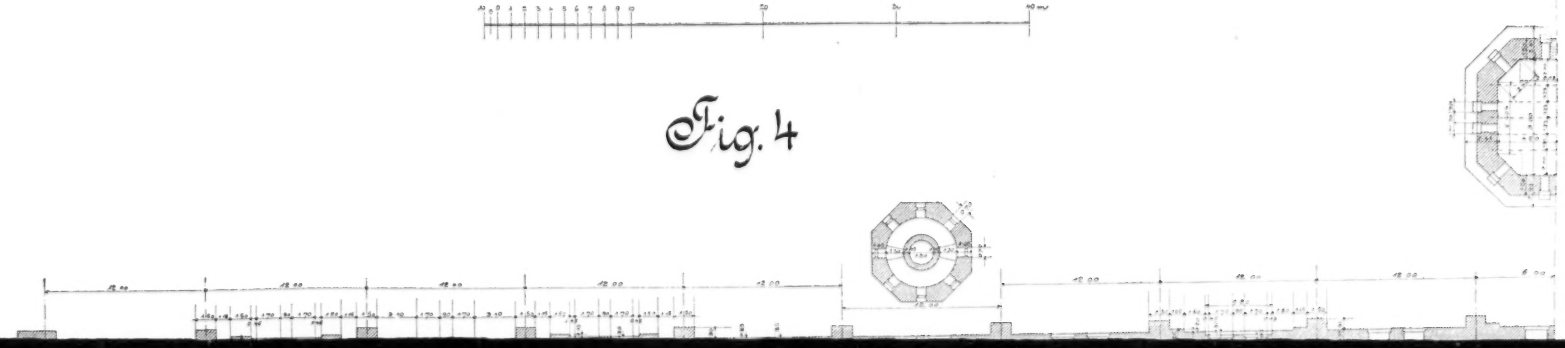


Fig. 4



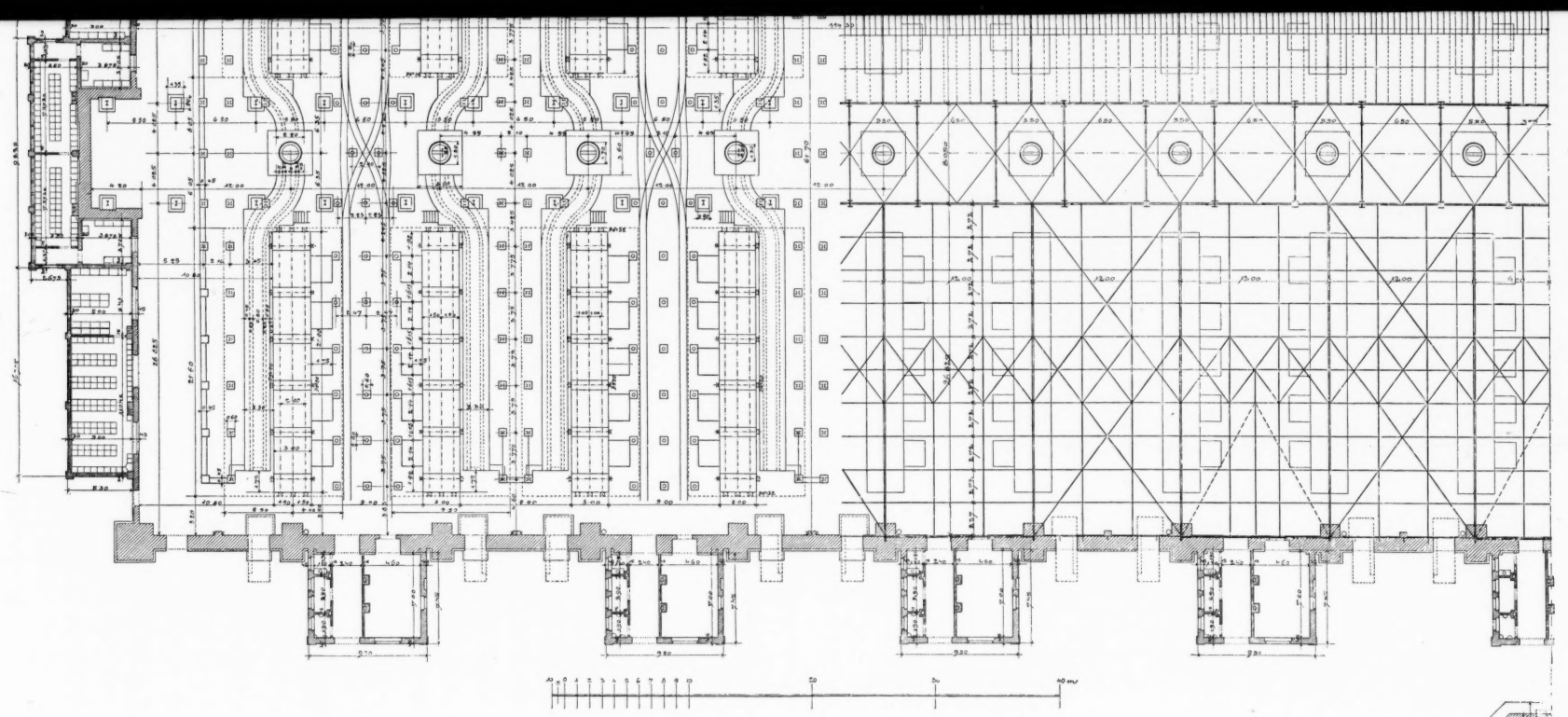
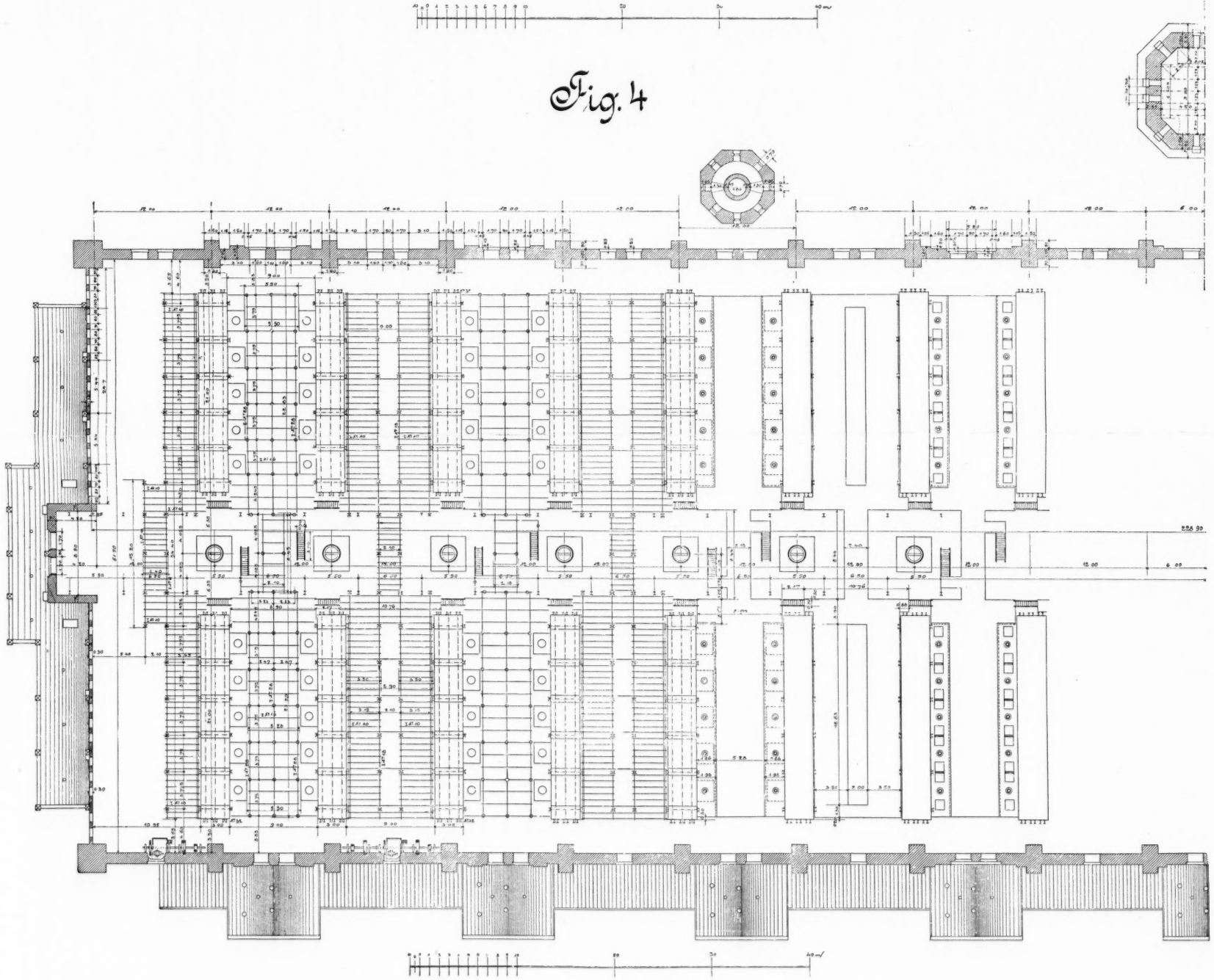


Fig. 4



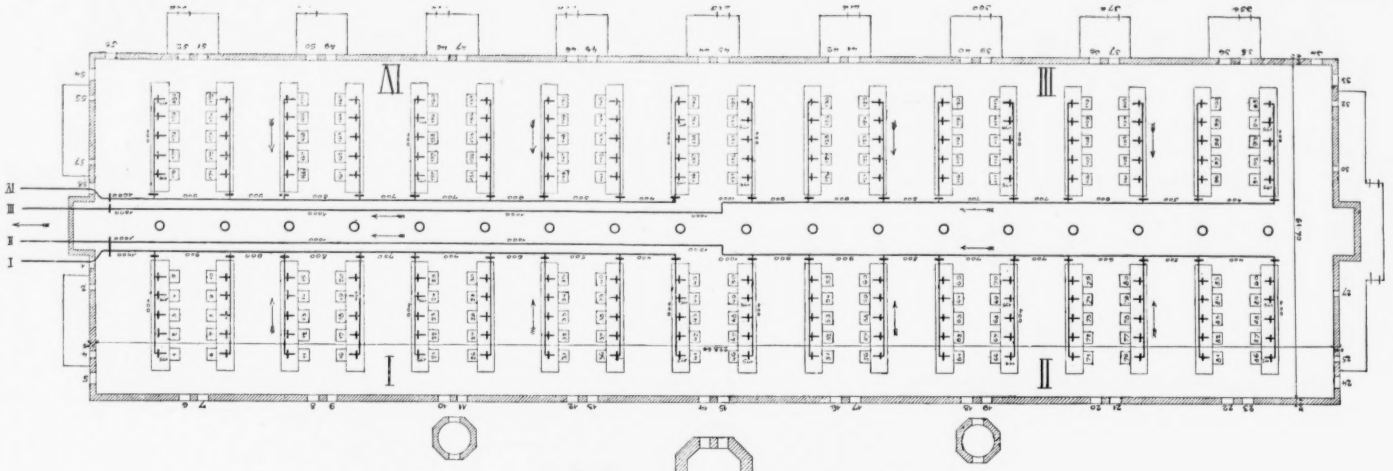


Fig. 5

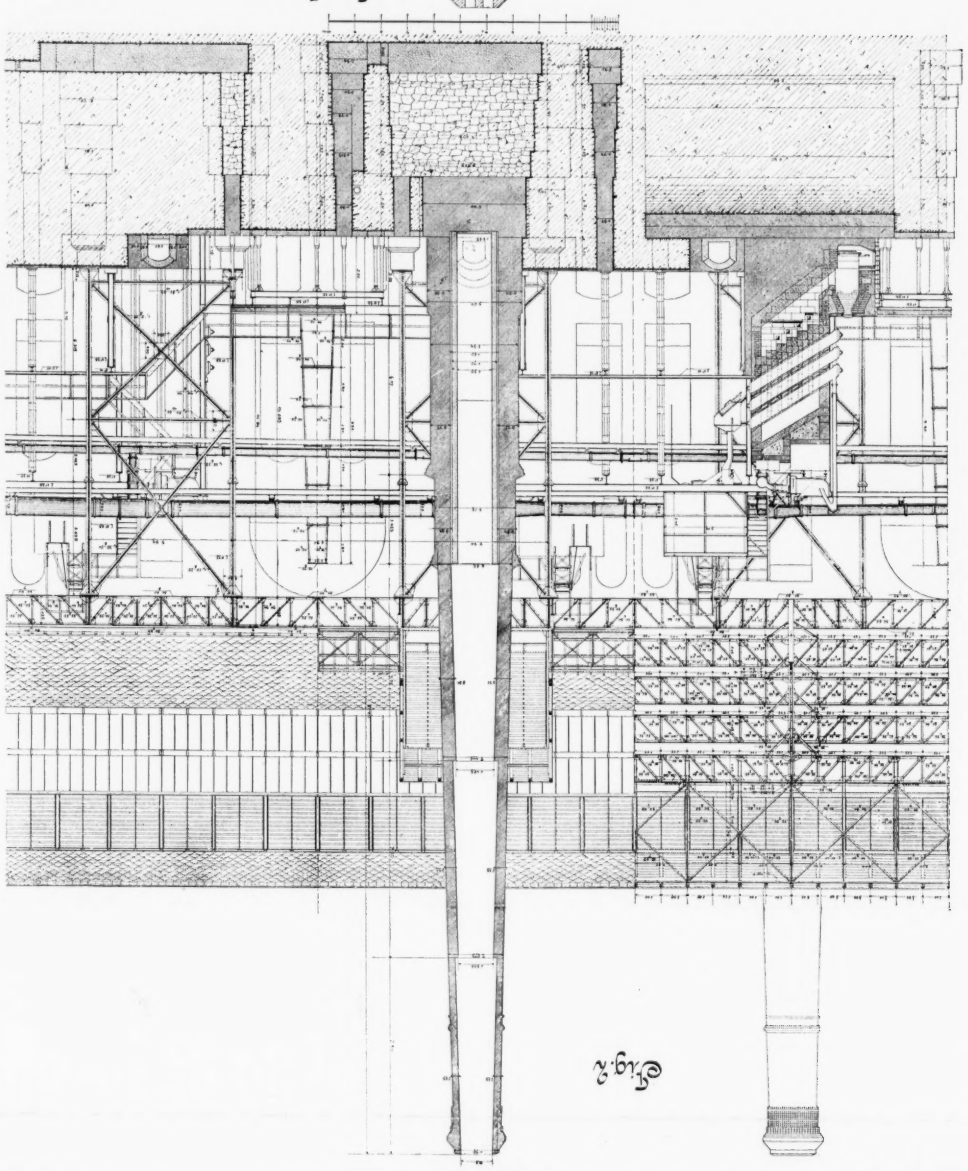
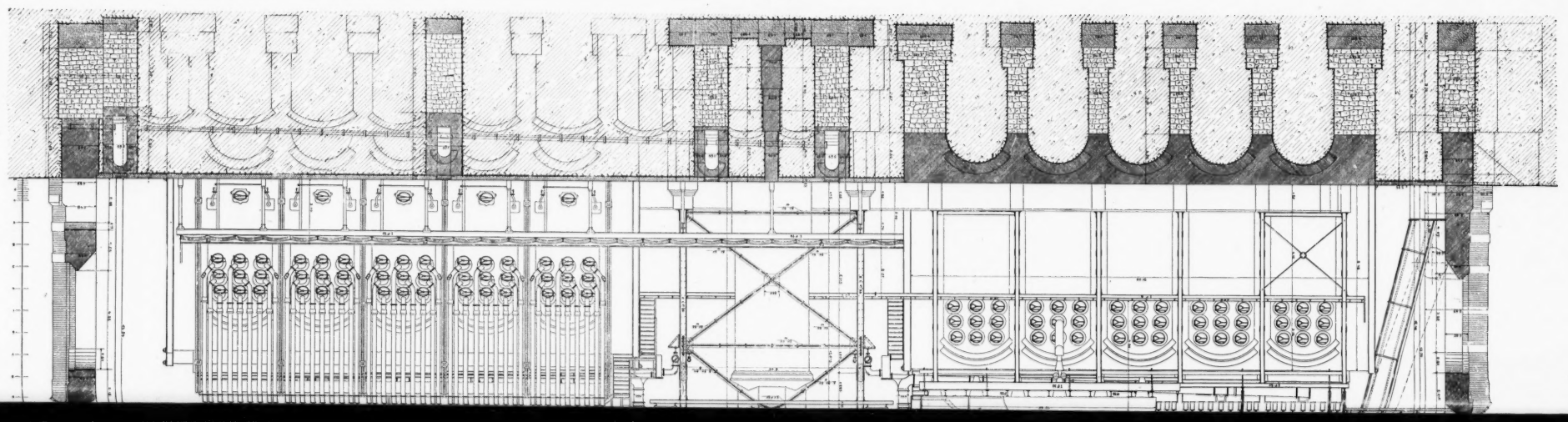


Fig. 2



THE RETORT-HOUSE AT THE VIENNA NEW GAS-WORKS.

Fig. 1

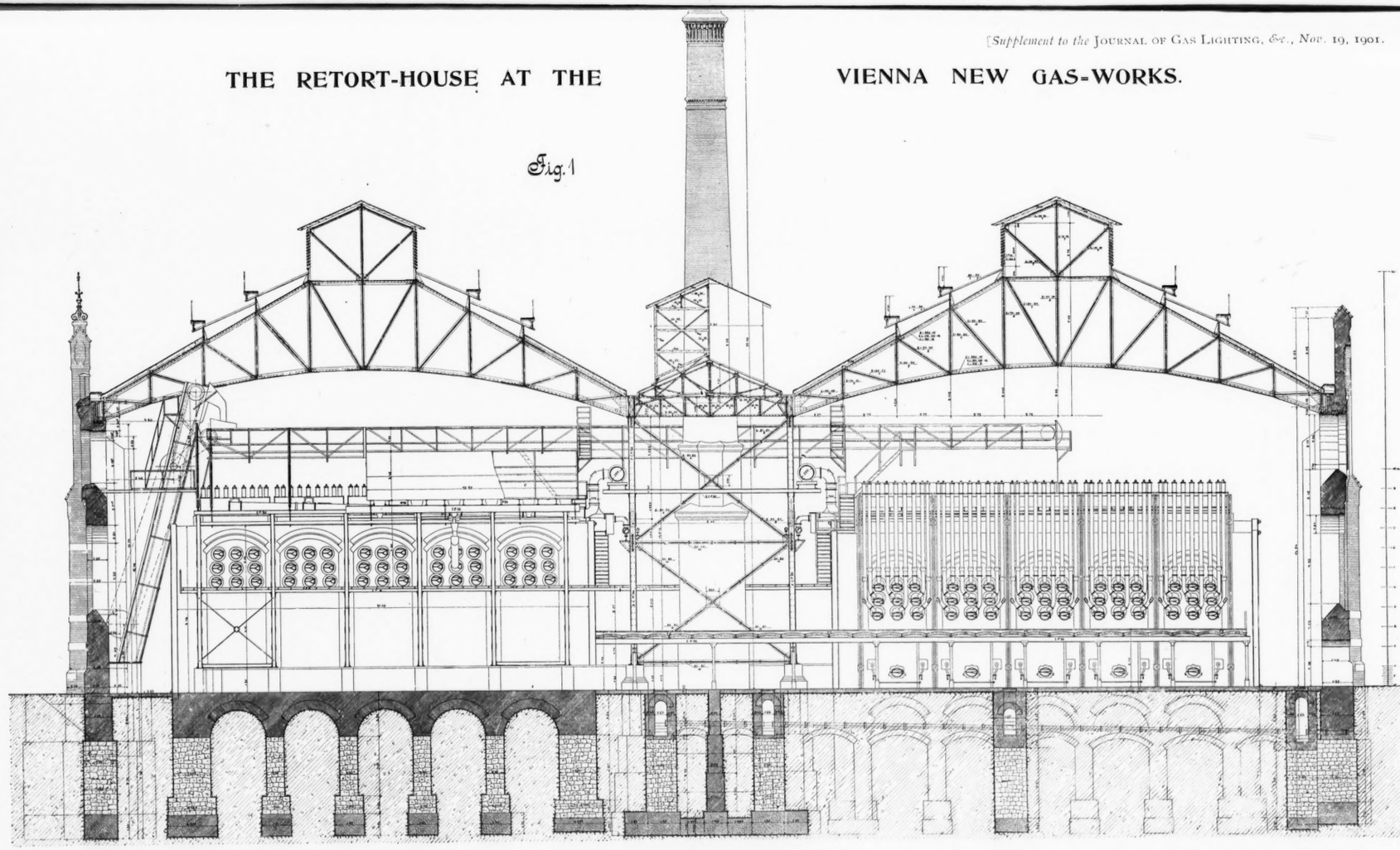
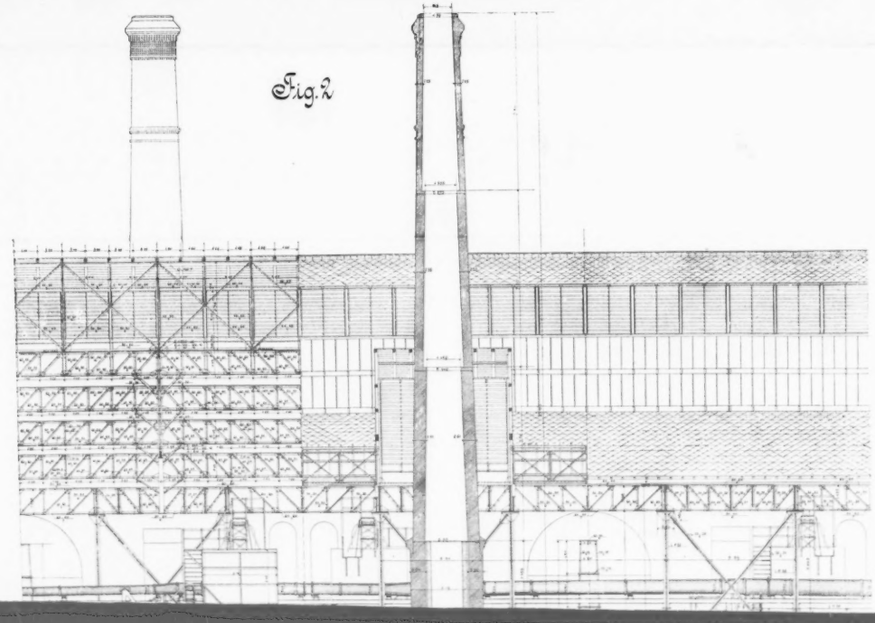


Fig. 2



pleased with the light, as there are no shadows, but an equable light throughout. The 6s. 10½d. is made up as follows :—

Gas	0·33d.
Mantles	0·10
Renewal burners	0·01
Pilot light	0·01
Labour	0·05
Contingencies	0·05
	0·55d. per hour for 433 candles.

This is a reduction of about 20 per cent. on the entire charge during the past twelve months; and no credit is due to the burner and mantle makers. We have to use burners of no more illuminating power than we had eighteen months ago; and whether they will be more enterprising remains to be proved. At 2d. per unit, the electric arc would cost 0·43d., against gas 0·33d.; or, in other words, gas would have to be 2s. 6½d. to equal the electric arc at 2d. per unit.

Now, will any electric light installation compare with this one at £450 (net cash), light for light? Can you obtain a thoroughly distributed electric light installation to displace flat-flame gas-burners, and give 250,000-candle power at a cost of £1700 and an annual saving of from £200 to £400 per annum, with nine times more light? Under the old system, we obtained 71-candle power for 1d., and under the new system 787 candles.

It must be clearly understood that this was accomplished only after very careful consideration; but the result justifies the trouble. Care must be taken to ensure the thorough up-keep of the light after it is done. But who would expect an electric arc lamp to look after itself, or question the number of carbons it uses when the total cost has to be considered? Burners, mantles, and lamps do deteriorate unless well looked after. It is a pity to allow the light to diminish below 30 candles per cubic foot at any time; and for this reason I am impressing the point more than may appear necessary. For the sake of increasing the cost (say) 3d. per hour, or even beyond this sum, during lighting hours for a large number of lights, it is better to have a thoroughly capable man to attend to the work. The expense should bear this. Gas lighting has at times a bad name; and it should not have. Unless we recognize the responsibility for the up-keep of high pressure lighting, it will be better by far to leave the system alone altogether.

I do not wish it to be understood that in all cases flat-flame burners can be displaced by high-pressure incandescent gas lighting; but the number of burners can be reduced to an enormous extent by the proper and practical application of the light suited to the particular positions, or class of work, to be performed. In the present instance, the building was ripe for electricity; but gas can do the work at 0·09d. per unit. Again, it may not always be applicable or desirable to put up a complete installation of high-pressure gas and dispense with the naked flames; but, in any event high-pressure lamps would compare most favourably with electric arc. In fact, gas at 2s. per 1000 cubic feet and electric arc at 2d. per unit is slightly in favour of gas—as 1d. is to 1·1d.—taking all charges into consideration. This is a very nominal sum for the electric, and for a few lamps only.

In some cases, lamps must be suspended by wire ropes and counterbalanced; others should be fixtures. We adopt both systems, as over running machinery it is practically impossible to give a distributed light in the places required if the lamps were fixtures. To fit up an installation for lighting a factory by flat-flame gas-burners for 500 men, and provide the piping, fittings bracket, and pendant lights, to give an illuminating power of from 8000 to 10,000 candles, cannot be done much under £450.

Let us see what other form of gas-light would compare with it. Firstly, the old system of lighting was bad, very bad. The pressure was too low for Kern burners, and only by a reconstruction of the mains from the holders—a costly one at that—and with the fitting of Kern burners for 1½-inches pressure (the most that could be reckoned upon) would mean 540 No. 4 Kern burners required; or, if mains and services remained as at present, 1080 "C" burners. To install these in lamps would mean an expenditure of £1000 in both cases; thus getting well on to the cost of an electric incandescent installation to equal the high-pressure light. The attention and cleaning would be greater; and as a forward movement in gas-light, certainly would not equal the high-pressure system.

Again, to alter all the fittings in the shop into those suited for "C" burners without lamps, would cost £500; and the extent of breakage would be enormous. Lighting of open spaces is not dealt with in detail here; but there is no practical difficulty in setting up tall posts, &c., to suspend from one to four 450-candle power lamps or even larger, as may be required. There is undoubtedly a better knowledge of gas lighting required for the improved system; and we must educate ourselves to meet the demand.

I cannot, as explained, give full particulars of all the various tests made; but I might add that 14 feet of gas per hour need not be the limit, either with a 10-inch or 54-inch burner. But, of course, the tendency is to reduce the light-giving power in ratio after the maximum value is reached. Consequently, the point is not settled as to the ultimate light obtainable.

I would now ask a question, and one that high-pressure gas lighting has brought before me, and that is—"Have we the class of men as gas-fitters who are capable of dealing with gas-lighting such as will be required in future?" I do not wish to depreciate their work, or say that we anticipate any difficulty in that direction; but certainly the men must have a better knowledge of their work, and a fairly good technical knowledge too, embracing at least some knowledge of light and heat, so that gas-lighting and the general use of gas for other purposes should become much more assured.

I think our electrical friends get ahead of us there, as the training of young men has so widened the sphere of usefulness, that lighting is not the only important one; and I shall be glad to see the day when to take charge of a gas-lighting installation, and maintain it afterwards, we shall have gas-fitters and lighting engineers capable of passing a good qualifying standard examination—both in practice as well as in theory.

I do not know how the question appeals to you as to the need for reducing the consumption of gas by applying it in an improved form; but there should be no question as to gas being better than electric arc for working by, and, if merely as an extra, for general purposes—leaving much of the flat-flame for intricate detail work. I am under the belief that a better use can be made by giving the light more attention, rather than the straining for a 1 or 2 per cent. more annual output; and to show you that we do not fear the notice-board "These premises to let," we have recently added a new retort-house to make a million feet of gas per day, and four 26 feet square purifiers. We are also telescoping two gasholders.

I might add, that in the installation method given herein, the pressure in the factory is raised by a rotary blower; and it has been found necessary to fit in an anti-fluctuator, as the draw-off interfered with the supply for other purposes. All oscillation is now entirely done away with. There are other instances where the blowers do not affect the lights; but I cannot enumerate all details here, beyond stating that it is convenient to set up distributing stations for the transmission of pressure for any number of lights—the size of blower being the only consideration.

Discussion.

The PRESIDENT (Mr. Corbet Woodall), in the course of the paper, asked Mr. Onslow to make clear to the meeting what the £450 and the £1700 represented.

Mr. ONSLOW said the £450 was for the installation of 150 burners; and the total estimate to obtain over 250,000-candle power, as was now under consideration, would be £1700.

The PRESIDENT invited discussion, and, after a pause, said he must confess that, while Mr. Onslow had been reading his paper, he had had some little difficulty in exactly understanding the line of some of the arguments used. But the subject itself was of such broad and general interest, that he should have thought it would have drawn observations from those (who really, as to number, were practically the whole of the members present) who were interested in, and had had experience with, high-pressure lighting. The only point on which he (the President) would make any remark at all was practically the closing one in the paper—that they must not grudge the improved results obtained from the gas on the ground that it might have the effect of reducing the amount of the consumption of gas. He believed that Mr. Onslow's experience was that of most of them—that, whatever their fears might be, at no previous time had they had greater difficulty in coping with the increasing demand for gas. He could not help thinking that this was, to a large extent, due to the introduction of burners—not necessarily high-pressure burners; but burners of the incandescent type, which had made gas continued in acceptance with so large a proportion of those who had hitherto used it for lighting purposes. No doubt the effect had been—and he knew of one or two towns in which it was very palpably so—that incandescent burners had reduced the consumption of gas. Not simply was there no increase, but there was an actual diminution in the quantity of gas issued in the case of Berlin. The Engineers of the Municipal gas-works of Berlin reported that the cause of this was more the incandescent gas-burners than the competition of the electric light; and since this effect had been overcome—that was to say, since there had been practically a complete transference of the lighting from the ordinary burners to the incandescent burners—the rate of increase had gone on as satisfactorily as ever. Their first duty was to provide an efficient and cheap light for the consumers; and that done, there need be no fear as to the demand. The public would not remain content with anything short of the best means of lighting. He hoped that all those who had had experience with high-pressure burners would let them have the benefit of it before the close of the meeting.

Mr. T. MAY (Richmond) suggested that some of those gentlemen who had had experience of high-pressure lighting should tell them whether the form of burner they used was better than the Kern burner. Was it, he asked, necessary or desirable to go to the patentees of other forms of burners when they could go to the Welsbach Company and get the Kern burner? They were given to understand that what had to be done was to use a different form of burner for high-pressure lighting; and if some gentleman could give them information on the point, it would be useful.

Mr. F. W. CROSS (Lea Bridge) said he did not think gas suppliers were at all sorry over the spread of incandescent lighting. It might retard their progress a little; but, in the end, it gave satisfaction to the consumers, and that was what they all aimed at. In his district, they had a small installation of high-pressure burners; but he could not at the moment supply any data as to its working. The burners were not Kern ones; but they gave

every satisfaction. He would not have mentioned this example of high-pressure lighting, but for the fact that in September last the District Council started electric lighting. Naturally a number of the shops in the district had taken on the electric light, among them the draper's shop at which this high-pressure gas installation, consisting of eight large outside lamps, was situated. The shop was a corner one; and the proprietor had taken the electric light for the interior of the shop and for adjoining new premises which he was building. He (Mr. Cross) asked him a few days since whether he wanted him to remove the high-pressure system. The proprietor's reply was "No; the Electrical Engineer says it is the best lighted shop in the whole district, and it is going to remain so." That was his (Mr. Cross's) experience of high-pressure lighting. The light was good; but the only drawback they found was, as the burners had been fitted to the old lanterns, they were a little bit more draughty than if they had been made specially for the purpose. He believed there was a great future in front of high-pressure lighting. Of course, the expense was great; but this would be got over in the future. The difficulty of discussing Mr. Onslow's paper was that it related to pressures of 25 to 30 inches, or rather more, which perhaps was unattainable by them with safety in small installations. But, of course, that pressure with Mr. Onslow's blowers was easily obtained.

Mr. J. H. Brown (Ilford) said there had recently been erected in Ilford a range of 25 shops, let at about £40 to £45 per annum. The tradesmen who had taken these had formed themselves into an Association to light up the whole of this particular street from the outside of their shops. The District Council were the electric lighting authority; and they were asked to quote a price for arc lamps to be erected and supplied with electricity, suspended from an arm 9 feet in front of the shops. He (Mr. Brown) attended a meeting of the Association, and made them an offer to supply high-pressure incandescent gas-lamps of 1000-candle power each, at £5 per annum for 500 hours' lighting. After a good deal of discussion, he obtained the order for the installation. He had erected a compressor, capable of supplying about 1000 cubic feet of gas per hour, at 10 inches pressure; and 28 of the arms had been fixed, each bearing a three-light cluster, which gave on the photometer a little more than 1000-candle power. These lamps had been running for a fortnight or three weeks, and had given great satisfaction. It might interest the members to know how he arrived at this £5 per annum. The lamps each consumed a little under 30 cubic feet of gas per hour; and 500 hours, multiplied by 30 cubic feet, equalled 15,000 cubic feet. This, at 3s. 6d. per 1000 feet, worked out to £2 12s. 6d. The mantles (he estimated these by a similar lantern with which he had had experience) came out to slightly over 20s. per annum. The cost of the bye-pass was amply covered by the £1 7s. 6d. remaining. He calculated that they would make £50 profit on this installation, apart from the profit on the gas. He had eleven compressors at work in the town, some of which supplied fifteen burners, others eleven, twelve, and even as many as twenty. The system had been a great help to his Company in fighting the electric light. They had serious competition from the Local Authority. They were erecting electric incandescent lamps to cost £9 18s. 8d. a year; and for some time past, he (Mr. Brown) had been putting up incandescent gas-lamps free of cost by the side of them—the result being that the District Council had given them a fabulous price to take the lamps down. His Company were glad to receive the price, because the lamps were of no use to them. With respect to Mr. Cross's objection to the expense of these lights, the Local Authority, he might say, offered to supply the shopkeepers with electric arc lamps at £17 8s. 6d. per annum, so that the cost was much in favour of high-pressure incandescent gas lighting. The tradesmen were quite satisfied with the lights; and only last week he received five more orders from other shops in the neighbourhood for similar lights. There was another case in point—the lighting of the Drill Hall. They had in the town a Horticultural Society, who were holding their show there this week. They approached the Local Authority for a temporary supply of current. The cost of the electric installation was £8 8s.; and the cost of the electricity was estimated at from £2 to £3. He (Mr. Brown) gave them an estimate for fitting up the high-pressure gas for 35s., including gas; and this yielded them a profit. The authorities were quite satisfied. The light was perfectly steady; and they said they had a better light than they had had for years at their shows.

Mr. H. H. Jones (Wandsworth) remarked that 500 hours' lighting per annum seemed to him to be a very low figure to take. On the basis of his own lighting table—4300 hours—the price charged by Mr. Brown would work out at £43 per annum.

Mr. Brown replied that they lighted these lamps from sunset to nine o'clock every evening except Thursday and Friday. On Friday, they were lighted from sunset to ten o'clock; and on Thursday, there was no lighting on account of the early closing.

Mr. Onslow said he must apologize for his paper. It was not quite what he should have liked it to have been. He had a great deal more to say; but he did not know how to put it. The plain fact was that he had hoped there would have been a good discussion, which would have brought out the points that he wanted to explain. The remarks of the President about reducing the consumption of gas, and applying it in a higher form were very good; and he (the speaker) was confident, if that was carried out, they would not lose any consumption of gas per annum. The use of gas in the manner in which they could obtain the highest possible results from it would draw more attention to gas lighting, and keep custom away from the electric arc lamp. His own object was to see whether they could not supply light, candle power for candle power, as good as any electric arc light at less cost; and he had succeeded in doing so. There was no doubt about it that his installation was a very fair instance of what could be done by gas in competition with electricity. With regard to the point as to the whistling of burners, they had whistling in some of their burners. But out of the whole of the 150 burners, working at a 54-inch pressure, they would find that only two or three would whistle for some 30 seconds after they were first lighted, and not always the same burners. The noise was a peculiar hissing sound. But the burner was a curiously toothed one; and the whistling was in all probability due to a number of minute explosions taking place inside the burner itself. When the burners which were whistling got warmed, the noise ceased. There were several other types of burners; but they had never gone to the amount of pressure he required. What they wanted to do was to get the ultimate value in the way of light out of the mantle. If a 10-inch burner was used, and 10 cubic feet of gas were consumed, they were told they got 310-candle power. What he wanted to do was to get more out of that burner; and he was not satisfied they had obtained the ultimate value out of the burners yet. As to the life of the mantles, the difference in the amount of breakages between (say) 10 inches and 22 inches pressure was scarcely perceptible. As a rule, the mantles lasted 150 hours. The men found the light a splendid one to work by; there were no shadows; and they were able to see the most intricate work on their benches by means of the lamps.

Mr. May asked whether Mr. Onslow used a No. 4 mantle on a No. 4 Kern burner.

Mr. Onslow replied that they did not. They had a specially made double mantle. It was of the same size as the No. 4 mantle. They were made one on the top of the other, and were stronger—30-cotton. The charge for them was 1s. 3d. each. His great object was to get so much light from a burner that they could have (say) a 2000-candle power lamp. He believed it was to be done, and that they would be able to compete easily with the 2000-candle power electric arc lamp.

WRIGHT AND CO.'S GAS-HEATING NOVELTIES.

Messrs. John Wright and Co. have this season added a number of new patterns to their range of designs in gas fires and stoves, all of which may be truly said to have features of distinct interest. Before, however, referring to two or three of these, it may be remarked, in connection with recently-noticed improvements by other makers in the direction of the ready removal of gas-fire fronts and burners, that Messrs. Wright remind us that, for several years past their fires have been so constructed that the stove front can

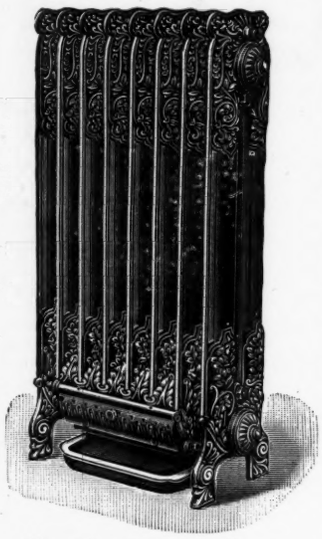
The "Kaiser" Stove.

be withdrawn, either by slightly raising it, so as to disengage it from a hook catch, or (in some patterns) by loosening a couple of screws—the removal of the burner being thus, in either case, instantaneously effected.

Turning to this winter's novelties, a new massive and elegant hall stove—the "Kaiser"—attracts special attention by the freedom and grace of its design, which give it quite a place of its

own among patterns of this class, both as stove and as gas-fire interior.

The particular design with which Messrs. Wright and Co. will expect to make the greatest impression is a new type of condensing stove, which, they claim, marks a clear advance on previous attainment in this direction. The makers of the "St. Patrick" gas radiator admit their obligations to our Transatlantic cousins for the general outline of the radiator, which they were the first to divert from its steam-heating uses, and fit up with the ball fire, as a gas-heated apparatus. The "St. Patrick," however, differs from its predecessors, in that it approximates more closely to the tidiness and safety of the steam radiator, by dispensing with the open fire altogether, and shutting the atmospheric burner into a compartment beneath the tubes. In this compartment, complete combustion is effected; the heated current thereafter taking its up-and-down course through the successive tubes. The burner has two positions—when the lighting door (shown in the illustration) is opened, the burner turns outwards to "lighting" position, so that not only is it more readily lit, but while this is being done no gas can get into the radiator tubes. When the burner is lit, the door is closed, and the burner resumes its upright or "burning" position. A stove with no fuel or other surface to impinge on the flame during combustion, and with even more than the ordinary amount of condensing space, ought to come as near to the ideal of freedom from smell as is possible under ordinary conditions; and, indeed, the makers go the length of maintaining that, without any exaggeration whatever, they have at least succeeded in making a stove which needs no flue, because there are no unpleasant fumes to carry off. It will be interesting to notice how this contention is borne out once the stove has been tried under varying conditions.

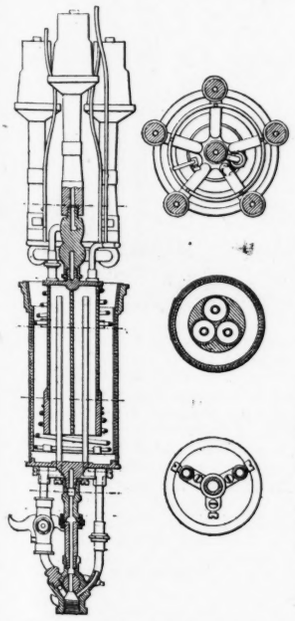


THE "ST. PATRICK" STOVE.

REGISTER OF PATENTS.

Incandescent Lighting.—Coe, F., of Derby. No. 20,588; Nov. 15, 1900.

The object of this invention is to prevent damage to mantles of incandescent gas-burners through vibration or sudden shocks.



The patentee employs an outer vessel open (as shown) at the top to the atmosphere — preferably cylindrical in form, and made of any suitable material, and of convenient depth for the purpose of containing oil, glycerine, mercury, or other suitable liquid to act as a seal for the gas. Within the vessel, rising from apertures in the bottom up to within a short distance of the upper rim, are open tightly-fitting pipes for the gas. Within the vessels there are cylinders open at the lower ends, surrounding the first-named pipes; the upper ends of the cylinders being hermetically sealed, but each perforated with an outlet for leading away the gas.

For the purpose of preserving the mantles from shock, these cylinders are fixed to, and supported upon the ends of, spiral springs, the other ends of which are securely fixed to a removable lining accurately fitting the main vessel. The cylinders thus mounted upon springs (and balanced as hereafter mentioned) are passed down over the gas-pipes into the outer vessel previously supplied with liquid —so forming a gas-tight connection, but free to oscillate in the liquid.

The burners are fitted upon the spring-mounted cylinders already described; gas being led to them through tubes from the upper or sealed ends of the cylinders. In order to maintain the burners in a vertical position, a balance-weight is fixed upon the lower part of the cylinders; the weight being so proportioned that, when the outer vessel vibrates laterally or vertically under shock, the interior cylinders remain comparatively unaffected.

The number and arrangement of the cylinders and gas-pipes will (the patentee points out) vary according to the number of burners or clusters of burners required to be lighted, reduced, or extinguished either simultaneously or independently of each other. For a non-bye-pass burner, one cylinder and gas-pipe will suffice. For a bye-pass burner, two cylinders and gas-pipes will be needed. When it is required in addition to light, reduce, or extinguish either part or the whole of a cluster, three tubes and gas-pipes will be needed, as shown. Here the arrangement is adapted for independent lighting, reducing, or extinguishing; and it is so fitted that either one, five, or six burners may be lighted, or extinguished, independently of each other.

Purifying Acetylene.—Smith, G. G., of Florence, Italy. No. 20,073. Nov. 8, 1900.

The patentee states that, in the course of experiments made in connection with the manufacture of acetylene, he found vaseline acted as an excellent dryer, extracting the moisture contained in the raw gas coming from the generator; and this use of vaseline was embodied in his patent No. 12,240 of 1900. But subsequent experiments have shown that vaseline may also be successfully employed as a purifier of the gas; it having been proved that it removes many impurities, provided that the apparatus by which the purification is carried out is so constructed as to overcome the difficulties inherent in the agent.

The present invention consists of an improved "depurator" for acetylene, by passing the gas coming from the generator, once or several times, through liquid vaseline. It further comprises means for preventing the vaseline from bubbling over into the pipe leading to the gasholder, and means for regulating the pressure in the depurator so that the water extracted from the gas will be automatically discharged. Means are also furnished for distributing the gas through the vaseline in finely divided streams or jets.

Incandescence Mantles.—Berend, O. A.; a communication from J. R Schauer, of Weiport, Bohemia. No. 22,470; Dec. 10, 1900.

This inventor claims the production of a mantle which has greater strength and rigidity than ordinary mantles, as well as great light-emitting power. He uses a twill-knitting machine to manufacture the fabric of which the mantle is made, as the skeleton of oxide produced as a result of the peculiar shape of the meshes and notches made by a twill-knitter is "considerably more open and accessible to the hot gases of combustion than the skeleton made from fabric of ordinary plain mesh"—like the Welsbach mantle.

Manufacture of Cyanogen Compounds from Gas Mixtures Containing Ammonia.—Besemfelder, E. R., of Charlottenburg, Germany. No. 4323; Feb. 28, 1901.

In the manufacture of cyanogen compounds from ammoniacal gas mixtures at a high temperature, the patentee claims the following operations or distinct improvements: (1) Relieving the gas of aqueous vapour previous to the decomposition, preferably by means of a strongly alkaline cooling liquid, with which the gas mixture is brought into direct contact, in order to remove, besides the steam, also the free and combined acids of the gas current, which are detrimental to the quantity and purity of the product. (2) Driving out the ammoniacal gas mixture which has remained in the cyanogen generator, by gas residue relieved of cyanogen and ammonia, before the heating-up stage, and driving out the gases of combustion produced by the heating-up operation, by means of the gas residue, before the renewed introduction of ammoniacal gas mixture to be converted into cyanides. These operations are preferably carried out in several cyanogen producers filled with highly heated carbonaceous material, each of which is separately connected with a common chimney-flue, also with a cyanogen absorber. There is a common supply-pipe for the ammoniacal gas, for the gas residue, and for the compressed air; the cyanogen generators being also capable of being connected among themselves in the sense of the progress of the working process, and provided with ash-pits and carbon feed, so that they may be made to work in a continuous circle, similar to that of the diffusion batteries of sugar factories, or to the cylinder batteries of the Hargreaves process.

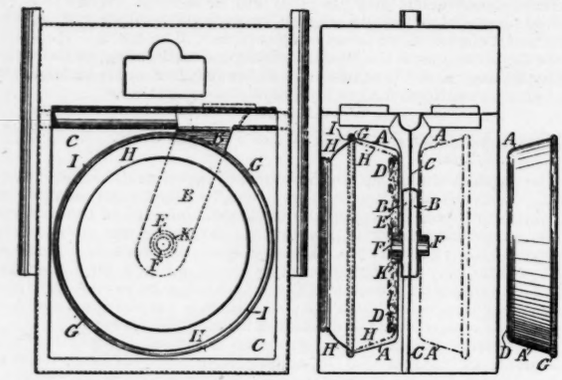
The ammoniacal gas mixtures used for obtaining cyanides (usually derived from the destructive distillation of nitrogenous organic matter) are, says the patentee, strongly charged with steam and carbonic acid, and other acids, besides containing ammonia, amines, hydrocarbons, carbonic oxide, and other gases. Hitherto it has been customary to partially convert the gas current generated by dry distillation, immediately afterwards into ammonium cyanide by means of hot catalytic substances; and it was not, therefore, possible, without considerable waste of ammonia, to obtain the satisfactory yield in cyanides which is attainable if the gaseous products of distillation are first relieved of steam and carbonic acid, and in some cases also of sulphuretted hydrogen and other acids, which are detrimental to the purity of the ammonium cyanide to be obtained. The separation of steam from the gas current may be effected most economically by cooling, preferably in immediate and extensive contact with cold caustic alkali solutions, which at the same time liberate and incorporate with the gas current the ammonia from the ammonium salts, which otherwise would be formed in the process of cooling, and remain dissolved in the water of condensation. In this way, it is possible to avoid the need for driving out the volatile and solid ammonia or ammonium salts in separate distilling apparatus. The yields of cyanides may be further increased by subsequently conducting the gas current (which has been cooled by the alkali solution to the temperature at which the latter enters) over caustic lime or other alkaline and hygroscopic bodies; so that the gas current applied to the cyanide producer is completely relieved of steam and acids.

Dry Gas-Meters.—Schofield, A., of Ashton-under-Lyne. No. 10,770; May 25, 1901.

This invention relates to dry gas-meters wherein diaphragms instead of bellows are used, so as to allow the diaphragm chambers to be quickly attachable to, and detachable from, the partition in the meter, and so facilitate testing and repairing.

As shown next page, in lieu of the usual ring and rim, the diaphragm

chamber is a dish-like receptacle A, the interior of which is brought into communication with the gas-passage B on the partition C in the meter, through the bottom D, by a tubular connection E F forming a



gas-inlet. The top or edge of the dish or receptacle is made internally with an annular groove G, into which the flexible diaphragm H is secured by a ring I gripping the edge.

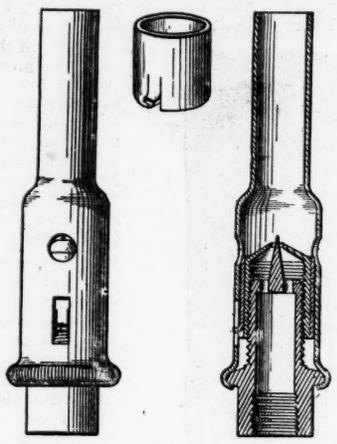
The said dish and diaphragm are of about equal capacity; and the former is of such a depth as to completely receive and cover the latter when in its inner position (see dotted lines).

The dish or receptacle is preferably stamped out of sheet metal in one piece; and the tubular connection is formed by a hole K in the bottom of the dish, preferably in the centre, furnished with a nut E to be screwed on to an externally threaded nozzle F secured to the gas-passage B, which for this purpose is brought to the middle of the partition in the meter. In this way, the diaphragm receptacle or chamber can be quickly screwed on to or off the partition, and removed from the meter when desired.

Bunsen Burners.—Kemp, C. M., of Baltimore, and Denny, G. H., of New York. No. 16,162; Aug. 12, 1901.

This invention relates to burners wherein the flow of the gas, by a slight manipulation of parts, may be increased and the flow of air simultaneously diminished, or *vice versâ*, so as to accommodate the burner to the quality of gas employed or the pressure at which it is furnished.

As shown, the gas supply-pipe comprises a short section of metallic tubing, with at its upper end a partition or diaphragm provided with a plurality of perforations forming passages for the flow of gas, and provided centrally with an upwardly-projecting tapered or conical valve. Formed externally on the gas-tube, and intermediate its ends, is a circumferential bead or collar; and between this and the upper end of the tube, the latter is externally threaded. Screwed over the upper threaded end of the gas-tube is an internally-threaded cap, provided



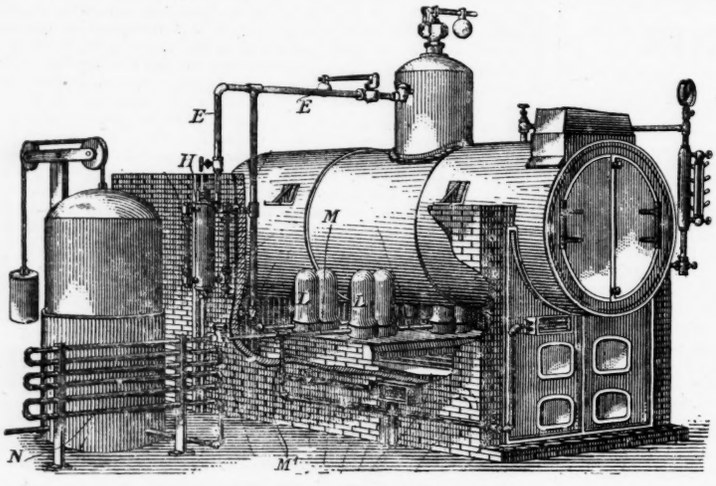
at its upper end with a top or head, which has a centrally arranged port or perforation through which the conical valve projects. By turning the cap about the gas supply-tube in one direction or the other, the cap will be raised or lowered, and the area of the port or perforations in the top of the cap will be increased or diminished—thus increasing or diminishing the flow of gas proportionately to the distance the cap may be moved vertically. Fixed on the cap is a cylindrical sleeve, preferably formed of thin sheet metal; and loosely fitted about the sleeve is the burner-tube, at its lower end provided with a flange which loosely embraces the bead or collar on the gas supply-pipe. The burner-tube is thus free to rotate about the gas supply-pipe, but is incapable of vertical movement.

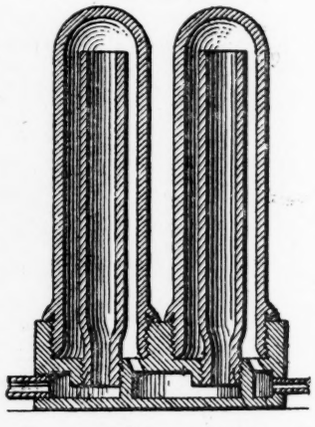
Gas-Making Process.—Cornell, E. B., and Alderson, W. C., of Philadelphia, U.S.A. No. 17,171; Aug. 27, 1901.

This invention relates to the manufacture of gas from steam and hydrocarbons, "in which the production of a fixed gas is ensured—that is, of a gas which can be stored and conveyed through pipes at ordinary temperatures like ordinary illuminating gas."

A perspective view of the apparatus is given; also a sectional elevation of a set or bench of retorts forming part of the apparatus.

The apparatus comprises a boiler, from the steam-dome of which a





pipe E leads to the top of a reservoir H, which is filled with, for instance, crude petroleum. This reservoir is like a sight feed lubricator, and connects with a branch-pipe leading from the pipe E to the retorts L arranged within the boiler-setting. The retorts are arranged in sets of two, with their shells screwing into a common base, which also receives tubular cores opening at the upper ends into the chambers which surround the cores, and at their lower ends into the inlet chambers. A vertical partition separates the inlet from the outlet chamber; and a horizontal partition provided with a passage separates the outer chamber from the outlet chamber.

By this construction, the steam and hydrocarbon in their passage through the several retorts are subjected to a series of successive contractions and expansions—thus "retarding them, so that the steam will be decomposed and the hydrocarbon completely broken up and thoroughly mixed with the decomposed steam." The retorts are subjected to considerable heat, and consequently high pressure (say, about 200 lbs. per square inch); and they are made of sufficient strength to resist. The formation of the core with a contracted lower portion and a widened upper portion, affords sufficient room for a strong horizontal partition and for an outlet passage of proper width. At the same time, the speed of the incoming fluid is reduced when it reaches the widened portion of the core; and the fluid consequently remains subjected to the action of the heat during a longer period.

The patentees call particular attention to the provision within the retort of a core which forms the gaseous fluid into a thin sheet or film, all particles of which are evenly exposed to the action of heat. In retorts used hitherto for the production of gas from heated fluid, there is (they say) a relatively slow and incomplete action, owing to the failure of the heat to effectively reach the particles of the fluid which are at the centre of the stream or body of fluid.

From the last retort of the set, a pipe M leads to the condenser or cooler N, the outlet of which connects with a gasholder outlet-pipe or service-pipe O_2. A branch-pipe M_1 leads to the burners P used for heating the boiler and the retorts.

The apparatus is started by burning fuel on the grate below the retorts L until steam is generated. The heat should be sufficient to make the retorts red-hot—not less than 1800° Fahr. The steam from the boiler dome flows through the pipe E, and in part directly to the retorts L and in part to the hydrocarbon reservoir H. From the latter, a certain amount of hydrocarbon passes through the pipes to finally reach the retorts in finely divided or globular form, together with the steam passing directly. Satisfactory results are said to be obtained by employing 1¾ lbs. of crude petroleum (of a specific gravity of ·875) for every pound of steam. The amount of hydrocarbon should be just sufficient to fix the dissociated steam. The steam and hydrocarbon pass first through the hollow core of the retorts, and then they spread in a thin film within the chamber, so that every particle of steam and of hydrocarbon is subjected to the intense heat of the

red-hot retort-shell. This causes the decomposition of the steam and the formation of a fixed gas consisting of carbon monoxide (CO), ethane (C_2H_6) and methane (CH_4), in about the proportion given by the following equation, which represents the probable reaction—

$$C_nH_{2n} + 4H + 2O = 2CO + C_2H_6 + 3CH_4$$

Crude Petroleum — Dissociated steam from the decomposition of $2H_2O$ — Carbon monoxide — Ethane — Methane

APPLICATIONS FOR LETTERS PATENT.

21,252.—Smith, C. W., "Combined gas and water regulator." Oct. 23.

21,304.—Hickman, J. B., "Slide-valves for regulating the flow of fluids or gases." Oct. 24.

21,336.—Podmore, A. E., and Thomas, J., "Incandescent gas-lamp fittings." Oct. 24.

21,356.—Hughes, G. H., "Production of gas." Oct. 24.

21,376-7.—Radcliffe, J., "Manufacture of gas." Oct. 24.

21,472.—Kitson, A., "Vapour-burning apparatus." Oct. 25.

21,512.—The Hygienic Stove Company, Ltd., and Greenwood, E. P., "Gas heating-stoves." Oct. 26.

21,534.—Killing, C., "Incandescent gas-burners." Oct. 26.

21,560.—Melhuish, A. G., "Gas and oil engines." Oct. 26.

21,577.—Wainwright, M., H., & A., "Exhaust silencers for explosive engines." Oct. 28.

21,613.—Melhuish, A. G., "Oil and gas engines." Oct. 28.

21,615.—Koblenzer, M., "Incandescent gas-mantles." Oct. 28.

21,630.—Boult, A. J., "Furnaces for solid, liquid, or gaseous combustible bodies." A communication from L. Van Den Driesche. Oct. 28.

21,692.—Fitzpatrick, H. D., "Incandescent lighting." A communication from F. H. Macpherson. Oct. 29.

21,720.—Humphrey, H. A., "Purification of gases." Oct. 29.

21,724.—Hunt, C. W., "Conveyors." Oct. 29.

21,740.—Terry, C. E. R., and Walker, J. H., "Gas heating-stoves." Oct. 29.

21,756.—Colborn, E. F., "Production of gas." Oct. 29.

21,757.—Cayrol, J., "Gas-burners." Oct. 29.

21,764.—Kitson, A., "Vapour-burning apparatus." Oct. 29.

21,771.—Burtwell, C. S., "Generating acetylene." Oct. 29.

21,837.—Schubert, A. L., "Producing lime or cement and combustible gases." Oct. 30.

21,926.—Farrington, R., "Protecting incandescent mantles." Oct. 31.

21,936.—Goulden, T., and Johnson, J. C., "Gas-stoking machinery." Oct. 31.

21,970.—Kitson, A., "Vapour-burning apparatus." Oct. 31.

21,982.—Feurt, W. A., and Martin, H. H., "Acetylene generators." Oct. 31.

22,016.—Crossley, W. J., and Atkinson, J., "Gas-producers." Nov. 1.

22,028.—Meischke-Smith, W., "Cooling cylinders of internal combustion motors" Nov. 1.

22,064.—Gibbons, W. P. & G. B. A., "Stoppers for inclined retorts." Nov. 1.

22,102.—Hislop, G. R., "Regenerative gas-retorts." Nov. 2.

22,104.—Bray, J. W., "Mantle supporting rods." Nov. 2.

22,105.—Bray, J. W., "Acetylene burners." Nov. 2.

22,131.—Humphrey, H. A., "Centrifugal apparatus for purifying gases." Nov. 2.

22,163.—Hampton, J. A., "Charging machine." Nov. 4.

22,243.—Adams, M. J., "Gas-fires." Nov. 5.

22,265.—Colbran, J. B., "Gas-burners." Nov. 5.

22,292.—Leslie, Sir B., "Measuring or conveying coal." Nov. 5.

22,349.—Schill, C. H., "Manufacture of gas." Nov. 6.

22,350.—Hamilton, J. H., "Internal combustion engines." Nov. 6.

22,370.—Waller, G., "Steam governor to regulate speeds of engines to suit varying make of gas." Nov. 6.

22,430.—Dumbell, J. S. & J. B., "Recording the number of coins passed into the money-box of an automatic gas meter." Nov. 7.

22,520.—Terry, C. E. R., and Walker, G. H., "Gas and like cooking stoves." Nov. 8.

22,595.—Edmondson, J., "Testing gases used in internal combustion engines." Nov. 9.

22,612.—Legge, J., "Safety locks for gas-meters." Nov. 9.

22,616.—Love, J., "Joint for fixing incandescent burners to ordinary gas-brackets." Nov. 9.

22,623.—Sloan, R. J. J., "A portable gas-hammer." Nov. 9.

22,645.—Westwood, W. H., Wright, E. T., and Westwood, W. W. S., "Discharging inclined retorts." Nov. 9.

22,648.—Doman, W., and Bullas, S. W., "Purifying gases." Nov 9.

Oriental Gas Company, Limited.—The Directors of this Company, in their report for the year ending the 30th of June, state that in the month of September, 1900, Calcutta was visited by a disastrous flood, which caused extensive damage. The Company's works escaped from serious injury; but business in general throughout the city was to some extent disorganized, and the sale of gas was for a while prejudicially affected. The course of exchange has been fractionally (0·1d.) worse; thus reverting to the average rate for 1898-9. The Directors have concluded a contract with the Municipal Commissioners of Calcutta for the public lighting of the city upon improved modern methods for a term of ten years. In their last report, the Directors announced the conclusion of a contract with the Municipal Commissioners of Howrah for the lighting of that district for a term of 14 years. The two contracts thus comprise the public lighting of the entire Metropolis. The balance of the profit and loss account (after payment of the interim dividend of 3½ per cent. and income-tax in June last, and after appropriation to the reserve fund) is £15,493, out of which the Directors recommend a dividend of 4½ per cent., tax free; making a total dividend of 8 per cent. for the year, and leaving a balance of £1994 to be carried forward.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

The Economical Advantages of Inclined-Retort Settings.

Sir,—It is not my intention to allow the discussion on this subject to degenerate into a mere quibble, such as Mr. Shoubridge seems desirous of dragging it to.

For the sake of historical accuracy, however, it is necessary for me to again revert to the question of the cross section of the Edinburgh retorts. The drawings for the New Street installation of inclined retorts were commenced in March of 1898, and the work put in hand, although its start was somewhat delayed, in consequence of the difficulty we experienced in removing the large (330-feet high) chimney stalk, upon the foundations of which the inclined retorts now rest. Slow fires were put under the settings in July of 1899; and coal was carbonized on the 2nd of October, 1899. Furthermore, in my paper to the North British Association of Gas Managers in July of 1900, there is a paragraph, referring to Diagram No. 2—that is what I now term the Edinburgh section—"shows the cross section applied by the author to the second installation at Huddersfield, in 1894; but, owing to an error on the part of the makers, it was not strictly carried out." Surely these facts warrant the general statement "that I have had these retorts working since 1898."

Mr. Shoubridge, in November of 1901, informs the world for the first time "that he made a design of a retort of *almost* this shape for the Birmingham Corporation Gas-Works, at Nechells, and sent it to Mr. Hack on Oct. 28, 1898; that Mr. Hack modified the design slightly, and approved it on Oct. 31; and that all the retorts at the Nechells works were ordered in November of that year," although at this time the site of the bench was a public park—*vide* "Journal," Oct. 18, 1898, p. 866.

I will most willingly accept Mr. Shoubridge's statement; but, as it only comes under my notice for the first time in November of 1901, I still maintain that the suggestion in my article in your issue of the 5th inst. was justifiable under the circumstances. For Mr. Shoubridge to say: "But it is not equally clear that he [Mr. Herring] did not copy me, for my drawings were sent to a number of retort-makers to tender from quite soon enough for him to have seen it before the retort I had erected in 1899," is mean, and, in my opinion, deserves to be characterized by some stronger term.

I am distinctly under the impression that I first applied this section of retort; I have certainly spoken of its importance on more than one occasion. But up to the present I have refrained from claiming any glory for it, and under ordinary circumstances would never have done so.

The first time Mr. Shoubridge referred to this section was in his comments upon my Congress paper, wherein he approved of the form, but did not even then say that he had adopted it either for his Crystal Palace installation or in conjunction with the Nechells works. Neither did Mr. Hack comment upon this section in his notes, when giving his experiences with the system at Birmingham. He merely refers to them as being Ω-shaped, 21 inches wide by 16 inches high at the charging end, tapering to 24 inches by 16 inches at the discharging end.

Mr. Shoubridge, at the end of the second paragraph of his letter, says: "Probably he [Mr. Herring] does not know who designed it." I candidly admit that I know of no other person than myself. Certainly, I gave the idea to the world first, and pointed out its advantages—in fact, the necessity "of such a form as to permit of the expansion of the coal in the retort rising without jamming itself into the arch or crown of the same, and that care must be taken that this formation is continued to the outer lip of the cast-iron mouthpiece," the face of which assumes an exaggerated form of the same section, in consequence of the cutting of this section at an angle with the horizontal base of the same.

It was never my intention to have laid claim to any credit for this; but seeing that my work is contested, I have for once departed from what I consider a salutary rule, and will leave the subject for your readers to adjudicate upon.

Now as to "inclined *v.* horizontal retorts." An anonymous writer, "Scot," expresses his views on important points of the subject under discussion. I am not at all sure that one like myself who has taken up the cudgels is necessarily called upon to combat with a phantom. The opinions of a man who has not the courage to attach his name to them are not usually of much account. Seeing, however, that the writer claims to be a fellow-countryman, and furthermore appears to be a thoughtful phantom notwithstanding, I will forgive him this once, and deal with the points he raises.

It is a *sine quâ non* that, to make a comparison, one must of necessity compare things on an equal basis. This necessitates, more often than otherwise, a most careful analysis and subdivision of items such as renders the comparison almost impossible to attain. This system, however, can be carried too far for practical purposes. The object we have in view is to discover by what means we can handle a ton of coal, convert it into gas, and dispose of the residual products, coke, and ashes in the most economical manner.

Conditions must vary in every individual works. Labour costs are fairly uniform; but the costs of material vary so greatly as to make a comparison of capital costs—excepting on the basis of the quantity sheets—impossible. But, as regards the labour, a great deal of information can be supplied by men of practical experience if they will only give us their detailed results, and thus enable a summary on a common basis to be arrived at.

"Scot" appears to be fairly familiar with the New Street Gas-Works, Edinburgh. I have not proposed to make a comparison between machine stoking at the New Street works and inclined retorts, or even with machine stoking at other gas-works. I desire to be perfectly fair in all my comparisons, as it is the bottom-facts I am seeking for.

When looking to the efficiency of machine stoking, I have preferred to take the Glasgow figures for the Arrol-Foulis machinery; and the

following are the carbonizing wages abstracted from "Field's Analysis" for the preceding six years :—

1895.	4·59d.	1898.	4·36d.
1896.	4·35	1899.	3·57
1897.	4·31	1900.	3·75

I think as these figures are the result of the working of one of the best-known types of horizontal charging machinery in the home of its inception, we are giving it a favourable place. The next thing we want is for somebody to supply us with similar figures for the West charging machinery.

I cannot for a moment agree with "Scot's" suggestion that the comparison must be restricted to the actual carbonizing costs—namely, the charging of the coal into the retorts, and the drawing of the coke therefrom. The coal breaking and conveying plant is not used identically for both systems, as "Scot" suggests.

The inclined-retort system with the continuous hopper was introduced to permit of the storing of a sufficient quantity of coal to serve through the night shift. This, in fact, is the only necessity for the storage hoppers; and with them the coal-elevating and conveying plant is worked an ordinary eight-hour day. In all cases that I know of where machinery is used, the elevators are running night and day. This necessitates the discharge of coal from waggons or store during the twenty-four hours, as well as the attendance of enginemen, boilermen, &c., all of which are done away with with the overhead hopper and inclined retorts. I admit, of course, that a sufficiently large storage hopper can be introduced for feeding the stoking machinery; but I maintain that these localized hoppers are, of necessity, much more costly in construction than the continuous hoppers over an inclined-retort bench.

Invariably with stoking machinery, the coal is received at several points from the waggons or store, and elevated to the localized hoppers situated at fixed points over the benches. With inclined retorts, the coal is received at one point only, and distributed by means of conveyors. Here again conveyors might be used for filling the sectional hoppers for machine charging—and, I think, with some economy on the present practice. I, therefore, maintain that the general arrangements of the coal-elevating and conveying plant in conjunction with inclined retorts is an important item of economy, and that the system should have the credit for it. The arrangements for dealing with the coke after it leaves the retort, are equally applicable to both systems; but the rapidity with which inclined retorts can be discharged renders a coke conveyor, or a rapid means of removing the coke from the fronts, a necessity not so apparent with stoking machinery. And while it will not be fair to claim any direct advantage from the mechanical quenching and transportation of coke from the retort-house for either system, the rapid removal of coke enables the inclined retorts to be worked more rapidly, with greater ease to the men engaged, and consequently more economically.

As to the heating arrangements and cost thereof. I rather think the advocates of machinery would prefer that the cost of the brickwork structure of an inclined-retort bench should be compared against that of a horizontal bench. There is undoubtedly more brickwork in it; and the cost of the setting is somewhat greater. As a set-off against this, however, there is a distinct gain in the area of ground occupied for a given carbonizing unit. For instance, my two experimental settings at the New Street works cover a piece of ground 24 feet long by 17 ft. 2 in. wide; and on this area I am carbonizing 37 tons of coal per twenty-four hours. I do not say that all inclined retorts are doing this; because I am working settings of nines, while others may prefer sixes, sevens, and eights.

For these reasons, therefore, I cannot accept "Scot's" suggestion to limit the comparison to the mere cost of charging and drawing the retorts, as it is calculated to result in a misleading conclusion. The main question is at what price per ton we can receive our coal, manufacture our gas, and dispose of our coke and refuse. These questions involve a most careful consideration of the capital outlay, the cost of repairing and maintaining the plant and appliances employed, and the labour involved in their manipulation. For the immediate present, I am not prepared to tackle this large question, though some day I quite hope to.

W. R. Herring.

Edinburgh, Nov. 14, 1901.

Inclines v. Horizontal Retorts.

Sir,—Mr. Herring's desire, as expressed in his "Communicated Article" to the "Journal" for Nov. 6, to get at the bottom facts of the relative merits of carbonizing by the two systems represented respectively by inclined retorts and horizontals worked by machinery, is one with which it may be assumed most gas engineers will be in sympathy. In view of the conflicting opinions held and expressed on the subject, it is highly desirable to have a definite statement of the actual results obtained in both cases; and as Mr. Herring credits me with having given the lowest figures obtainable with machinery on a large scale, I will endeavour to put the case for machinery in as clear a manner as possible.

It is not sufficient to say that at one works carbonizing by inclined retorts costs 10·3d. per ton, and at another with machinery the cost is 11·9d.; and to argue from this that the former is the superior method. As the items which go to form carbonizing wages vary at different works, it is worse than useless, in instituting comparisons between special devices which form a portion only of the whole, to take the total cost. The proper figures to take are those which alone are identified with, and incidental to, the working of the particular device. An inclined retort installation may have a special form of furnace, requiring less labour than those in use with the machine-worked retorts with which it is being compared; and there may be other special methods of performing the work, apart from charging and drawing, which would be productive of economy. But it would not be fair to give the inclined-retort system the credit for this; as it would be equally applicable to any other system of charging and drawing retorts. I propose, therefore, to give the actual cost for wages for carbonizing by one set of machines—taking only the labour employed upon, and rendered necessary by, the machines themselves, and leaving out all other labour which would be required in any case, with any other known system of carbonizing.

The machines in question are employed upon 300 through retorts, 20 feet long; and in 24 hours they draw and charge 2400 mouthpieces. The average weight of coal carbonized is 3¼ cwt., or a total of 390 tons for 24 hours. To perform this work, 32 men are required—consisting of machine-drivers, door openers and closers, men filling the furnaces as the coke is drawn from retorts, and the drivers and attendants of the engines working the machines. The wages paid amount to £10 10s., which works out at 6·46d. per ton. This is a plain statement of fact; and it should, I think, be sufficient to enable comparisons to be made. But it should not be forgotten that, when comparing these figures, due allowance must be made for different rates of wages ruling in different districts, as ours, I believe, are as high as anywhere.

As regards capital outlay, there is no doubt considerable variation in the expenditure on installations both for inclined retorts and for machine worked horizontals. I should probably not be far wide of the mark in putting the average cost of an inclined-retort installation at £100 per 20-feet retort, excluding only the retort-house itself, and all foundations below the ground-level. The cost per 20-feet retort at East Greenwich, excluding the same items, but including all the outlay on machinery, amounts to £72. This is an important point in favour of machinery, and means that the amount saved, at 4 per cent. interest, would provide 5 per cent. on the outlay for machines; and 5 per cent. is found in many instances to be sufficient to pay for the wear and tear of machines, and the makers are prepared to contract to keep them in repair for this sum.

Joseph Tysoe.

East Greenwich, S.E., Nov. 12, 1901.

P.S.—This was written before the publication of, but too late for insertion in, the "Journal" of the 12th inst.; and I was interested to note that "Scot," in his letter in that issue, holds the same views which I have expressed in the above.

Sir,—As I am in the same position as several other British gas engineers, and find it necessary to build an entirely new works for the purpose of providing for the ever-growing demand for gas for lighting, heating, cooking, power, and manufacturing purposes, I have been on the look-out for clear and definite information of any improvement or development in gas engineering, and have naturally been much attracted to the idea of working retorts by gravitation, if it could be shown to be a system which helped to secure the best results per ton of gas-making material. I was, therefore, much interested in the "Communicated Article" by Mr. Herring, regarding the relative costs of carbonization by inclined retorts and horizontal retorts with stoking machinery. But I think that he lays himself open to a considerable amount of adverse criticism, as the figures he quoted do not, to my mind, prove what he (Mr. Herring) intended them to prove.

I am quite aware that it is a most difficult matter to arrive at a fair comparison, inasmuch as no engineer has under his control two retort-houses, one on each system—viz., one fitted up with inclined retorts and another with horizontal retorts with stoking machinery—under exactly similar conditions regarding coal and coke arrangements, rate of wages, &c. And, in my opinion, until this is done, and the costs and results compared over a considerable period, we shall not be able to arrive at a definite conclusion as to which system of carbonization is the cheaper all round.

Dealing with the figures quoted by Mr. Herring, it appears to be unfair to compare the figure given by Mr. Tysoe, of 11·91d., with the figure of the working at Nelson, of 10·3d., as every engineer must know that the wages in London are very considerably higher than those at Nelson, and the general working conditions are probably altogether different.

It is a mistake, I consider, to quote the Nelson figure against the working of stoking machinery that Mr. Allan had previously had experience with. In the first place, the stoking machinery that Mr. Allan has had experience with, would be, I should imagine, in Sheffield and London; and the wages in these places are considerably higher than those at Nelson. In the second place, to my recollection, a coke-conveying plant is in operation at Nelson. This, therefore, introduces an important item, which must be considered in any comparison of costs with places not similarly equipped.

In my opinion, it certainly does not prove—even assuming, for the sake of argument, that the cost of carbonization by inclined retorts is lower than by horizontal retorts with stoking machinery—that in the long run it is cheaper to work with inclines than with horizontals. A figure must be added to the cost of carbonization by inclined retorts to compensate for the extra outlay and up-keep of the same; and this is generally admitted, I think, to be considerably higher than horizontal retorts and stoking machinery.

In comparing the two systems, we require a standard to work upon, as to what is exactly meant by "cost of carbonization," as, in the whole of the figures given on this subject, no two papers appear to agree as to the details included.

The last paragraph in Mr. Herring's article is extremely interesting; but I for one would prefer to see it backed up by some definite data. No doubt, there may be a few inclined retort installations which can compete with stoking machinery so far merely as the first cost of carbonization is concerned. But it has not yet been proved that these installations produce the best all-round results; as even the amount supposed to be saved per ton may be very quickly more than balanced by a slight reduction in the make per ton, and an increase in the cost of up-keep.

It must not be overlooked that the comparisons which have been made between the two systems are cases in which stoking machinery has been applied to existing retort-houses; whereas the inclined retorts have been entirely new installations. On this point and others, I am quite in accord with "Scot," as expressed in his letter in this week's "Journal;" and as I am very anxious that none of my Committee's money should be put on the "wrong horse," I am for the present going to be old-fashioned enough to stick to cheap, strong, and reliable horizontal settings with stoking machinery. I do not see anything yet to benefit the balance-sheet—either from the capital point of view, or from the net commercial results point of view, taken over a reliable period—in inclined retorts.

Samuel Glover.

St. Helens, Nov. 15, 1901.

The Production of Illuminating Gas from Coke-Ovens.

SIR,—In his reply to the Glasgow discussion, Dr. Schniewind quotes from my 1896 paper a paragraph which makes me appear as objecting to carbonizing in bulk; whereas my paper proceeds to show that, contrary to the general idea at the time—as expressed in Dr. Schniewind's quotation—oven gas, when properly treated, does not differ greatly from that which is produced by the ordinary gas-works process. This was proved—and, so far as I am aware, for the first time—by reference to actual ascertained results.

CHAS. HUNT.

Birmingham, Nov. 16, 1901.

The Coking Plant Gas Supply Scheme at Halifax, N.S.

SIR,—Herewith I enclose a cutting from the "Montreal Star" for Oct. 1, *re* the affairs of the Halifax Heat and Light Company. The statement is somewhat too optimistic, and the Company's report misleading "in important particulars."

Some four-and-a-half years ago, as reported in the "JOURNAL," a notice of the doings of this scheme was introduced to one of the Gas Associations on your side of the Atlantic, and great expectations were raised that their concern was demonstrating new and important economies in the production of illuminating gas and the other products of gasified coal. In point of fact, this scheme, as organized, never had the remotest chance of success, commercially or otherwise.

Professor Slocum, the leading Chemist at the Carnegie Steel-Works, Pittsburg, and the Father of the Heat and Light Scheme, proposed the erection of a small experimental plant at the Cape Breton Collieries (270 miles from Halifax); but Mr. B. F. Pearson—a Napoleonic promoter, in these parts—was able to influence that a more pretentious plant be put up at Halifax "instead."

Outside Professor Slocum, none of the promoters had the simplest knowledge of the subject, nor did any one of them put a dollar of his own money in the venture. But after obtaining legislation (an easy thing to get), they, by aid of hired newspaper literature, promised, "after the manner of Mr. Winsor in the early part of last century," all kinds of exaggerated results, with enormous profits to investors.

No local money is in the undertaking; but considerably over a million dollars of Upper Province (2000 miles away) money is invested in bonds and watered stock. A climax in its affairs would have been reached earlier, if some of the promoters who have reputations at stake had not handed over their promotion profits, to pay the accruing interest on the bond mortgages. The large liability for interest, combined with the unskilful construction, put an end to whatever commercial prospects it had as successors of the old Gas Company.

It is right to say that Messrs. Dempster supplied and erected the gasholders and purifiers, which are of first-class character; but most of the plant erected under local superintendence was "jimcrack," and "is a costly chaos." The coke-ovens gave out within six months, and had to be reconstructed.

The special ammonia plant in connection with their Mond producers got destroyed by fire; and although well insured it was not replaced, and the demolition of the producers followed.

Their pipe-line probably was unique for "botch-work" in the whole history of gas main-pipe laying. The promoters claimed that the arrangements of all older pipe-lines were out of date—"antiquated;" and theirs was to be put down on new and scientific principles. But actual results were that the pipes were badly laid and embedded—promoting numerous drawn-joints; and the joints were so imperfectly made, that escapes equal to tens of millions of cubic feet of gas per year resulted. Also there was constant flooding from underground springs, aggravated with every rainfall. Quite 75 per cent. of the joints have had to be uncovered and restopped; and the end is not yet.

They put down nearly 2 miles of special pipe (15-inch) to supply the Tramway and Electric Light Company with gas for power—not by the agency of gas-engines, but in furnaces to raise steam. After a week's trial, however, they discovered that the gross income of the tramway, &c., would not cover the cost of the gas fuel.

The report says they paid too high a price for the old Gas Company's property. The old Company were not desirous to sell out, but were not prepared to stand competition with a concern whose managers were not risking their own money. The old Gas Company's property was transferred for $368,000; and the Heat and Light Company, in turn, handed over to the Tramway and Electric Light Company the electrical part of the old Company's plant, for $100,000—leaving the net cost of the gas plant at $268,000. This latter plant had a capacity, and was well equipped with an earning power, quite three times the present business of the Heat and Light Company. Unfortunately for the new Company, they disintegrated the old Company's works; leaving the buildings and site, which (in common with much other property in Halifax) is of low value.

The price of electric light to domestic consumers here is equivalent to $1·50 per 1000 cubic feet of 16-candle gas; but the price of illuminating gas has lately been raised to $2 per 1000 cubic feet for an average 15-candle gas. Therefore it is no wonder that the old Company's yearly (stand-still) sale of 40 million cubic feet has fallen to 28 millions under the present management.

The heating gas, whether from coke-ovens or retorts, is the later product of the carbonization; and having duplicate mains and three gasholders, they are able to conveniently distribute the lower quality illuminating gas separately. Some months back, they increased the price of this gas by 100 per cent.—viz., from 40c. to 80c. per 1000 cubic feet; but to reconcile the consumer, they encourage the belief that the supply has been changed from a low-grade gas.

The report shows a sale of 44 million cubic feet for the year ending Jan. 1 last. This left them with over 1000 tons of surplus coke (for which there was no sale) at $3 per ton—with coal selling here at $4 (16s.) per ton of 2000 lbs. This embarrassing position compelled a resumption of the retort system of carbonization, to keep down the supply of coke.

Tar yields a good price. It is much in demand for tarred paper, used extensively for building purposes in Canada and the United States. Only a comparatively small quantity of coal tar is produced in Canada; much of the gas consumed being carburetted water gas, the tar from which is unsuitable. An import duty is also levied; and this prevents any lowering of the price by the competition of outside tar.

The ammonia is converted to aqua-ammonia and shipped to Philadelphia, 2000 miles. It barely covers cost.

It is thus very clear that the undertaking, with its small and diminishing business, and with no prospect of any future expansion, cannot pay interest on $800,000 mortgages, to say nothing of dividends on the capital stock.

The exploitation of this scheme will have juggled in losses over $1,000,000 out of the investing public—first, by the diminished price of the old Gas Company; second, by the inevitable large shrinkage of the bond mortgages; and, third, by the absolute loss to those who have purchased the common stock.

The Halifax Heat and Light Company was much advertised as the pioneer prototype of the larger concern established at Everett, Mass.—viz., the New England Gas and Coke Company. Although conditions exist there for a partial materialization of the scheme, and notwithstanding much bolstering up by bold manipulation, its fortunes are not promising, and its bonds are down to 50 per cent., and stock to 5 per cent.

The promoters of this concern, by the expenditure of large sums of money, obtained a Charter to supply Boston and its environs with gas in competition with the existing gas undertakings; but the then State Governor vetoed the Bill. Another measure was, however, passed to compel the Gas Companies in possession to buy gas in bulk—whenever the New England Gas and Coke Company were in a position to supply it of the required standard—at a price sensibly below what the older Companies can manufacture it for themselves. This converted the older concerns into gas distributors (merchants) only. They are also under obligation to give the consumers the benefit of the economy in cost.

The New England Gas Commissioners are to be the arbitrators or regulators when the question comes up.

So far, the New England Gas and Coke Company have not been able to take advantage of this provision; but during the past session of the Legislature, they sought to get power to compel the older Companies to take the crude gas in bulk, and purify and enrich it themselves. The application did not, however, succeed. Mr. W. H. Whitney, the leading promoter of the Company, was President of the Dominion Coal Company; and in that capacity he made a favourable contract with his other Company to sell them coal at 50 per cent. below the market price.

The Nova Scotia Government are the lessors of the collieries; and during the recent elections, they came in for much adverse criticism for legislating leases which permitted the sale of coal to foreign corporations at half the price charged to the home consumer. This low contract also was made the basis for rejecting the claims of the mine-workers for higher wages, commensurate with the increased market price of coal.

It is said that 500,000 tons are sent to this Company at $1·20 per ton of 2240 lbs. f.o.b.; the freight being about 40c. per ton. The difference between this and the market rate is more than $500,000, or a sum sufficient to pay 10 per cent. on $5,000,000. Coke sells in Boston at $4 per ton of 2000 lbs.; tar makes a higher price than with you; and they have possession of some small suburban gas undertakings. This, combined with the coke sales at a good margin over the first cost of coal, together with the good price realized for tar, just keeps the concern going from hand to mouth without paying interest.

W. P. BROWNE,
A Shareholder in the late Halifax Gaslight Company.

Halifax, Nova Scotia,
Oct. 22, 1901.

[ENCLOSURE.]

From the "Montreal Star," Oct. 1, 1901.

The bondholders in this city of the People's Heat and Light Company, of Halifax, N.S., have been notified that they will not be able to cash their bond coupons, the half-yearly interest on which was due to-day. The Company has practically defaulted, as it admits that it has not the money to meet the obligation. A majority of the bondholders have, however, agreed to take no action in the matter for at least a year; the idea being that in the meantime the Company may be able to pull itself out of the unpleasant position which it is now in. The interest, at the rate of 5 per cent. per annum, is payable half yearly, on April 1 and Oct. 1; and the present is the first time the Company has failed to meet the obligation.

The common stock, amounting to $700,000, and the bonds, $700,000 of first mortgage and $100,000 of second mortgage, are listed on the Montreal Stock Exchange; and a considerable quantity of both stock and bonds are held in this city, as the promoters came to Montreal to float their Company some years ago. For years there was some trading in the common stock; but very little has been heard of it lately—quotations, when there have been any, being of a constantly declining nature, until the stock was worth scarcely anything. The price of the bonds has been going down steadily as well. About two years ago they were quoted at 75; although there are many holders in the city who have them locked away in their safes waiting until they can get over 90 for them, to enable them to get out without a loss. About the most recent offer for the bonds in the Montreal Market was 15; but there were no transactions.

When the Company was organized some years ago, it acquired the existing Gas Company in Halifax at what was considered a pretty large sum, and moved the works from the city to a site on the north-west arm, where it was proposed to go into the business of not only supplying gas, but of developing the bye-products on a large scale, as well as manufacturing coke. The Cape Breton coal of the Dominion Coal Company was to be used in this connection; and it was said that the capitalists interested in the larger concern had interested themselves in the Halifax concern. Mr. Whitney has a similar plant near Boston. The venture does not seem to have been a success from the start—more especially the bye-products part of the proposition, which never seems to have got beyond the experimental stage.

The statement of the Company's affairs, made by the President (Mr. G. E. Boak), for the year ending March 31, 1901, is as follows: "While the business of the past year has not been as satisfactory as I could wish, and I am still unable to report that the net proceeds of the year's operations are sufficient to pay the interest on the bonds, I am pleased to be able to report an improvement over the previous year. The net profits for the year now ending are $20,167·28, as against $15,740·69 for the previous year. The improvement is due chiefly to the increased price which we were able to obtain for our coke,

The shareholders will observe that the profit for the year being insufficient to meet the interest, the Company had to make financial arrangements necessary to meet this condition of affairs, and the Directors believe that the arrangements made were in the interests of the Company. On May 1, 1900, the Company gave up selling fuel gas at 40c. net per 1000 feet, and, in place of the low-grade gas, sold illuminating gas for fuel purposes, increasing the price on an average of 34·9 per 1000 feet. Owing to the large increase in price, a large number of consumers gave up the use of it for fuel purposes; but while we sold 2,216,200 feet less gas, the net income was about the same as the previous year. The sales for the year amounted to 15,861,300 feet. The total sales of gas for fuel and illuminating purposes were as follows:

	1901.		1900.
Illuminating gas	28,164,500	..	30,380,700
Fuel gas	15,861,300	..	20,211,100
Total	44,025,800	..	50,591,800

Protection of Water Supplies.

SIR,—In your notes on the "Protection and Conservation of Water Supplies," in the "JOURNAL" for Oct. 29 (p. 1085), I find Mr. Parry omitted to mention a good example—viz., that the whole of the catchment areas for supplying Melbourne with water are reserved permanently for water supply purposes. They are vested in the Board of Land and Works; and the timber is not allowed to be cut down, nor is grazing of any kind permitted. In fact, both man and beast are excluded from the actual catchment areas.

Many readers of the "JOURNAL" would be assisted greatly if the instances of purchase of catchment areas were published from time to time, showing the enormous outlays made by companies to protect their sources of supply. I believe the Portsmouth Water Company spent a very large sum of money, and continue to contribute annually, in carrying out works that should have been undertaken by the Corporation for preventing the contamination of the water supply. Can any of your readers supply similar instances where corporation water committees have acted so generously on behalf of the consumers?

If we are in earnest to secure improved legislation on this subject, the conference must be composed of water-works engineers who are experts in their profession. It will be seen that the leading water engineers, the Institution of Civil Engineers, and other kindred Associations were not heard at this conference. The British Association of Water-Works Engineers are collecting statistics on the same subject, with a view to promoting a Bill in Parliament; and probably an amalgamation would lead to preferable, more reliable, and speedy results.

Nov. 14, 1901. Q. X.

Bakewell Gas Supply.—At the meeting of the Bakewell Urban District Council recently held, the Auditor (Mr. Chamberlin) reported that the year's profit on the gas-works was £67; but a capital expenditure of £248 was defrayed out of revenue during the year, to avoid raising a further loan. The net revenue from the undertaking, since the purchase of the works three years ago, had been £632. This was considered most satisfactory.

Land Purchases for the Leeds Washburn Valley Water-Works.—Mr. Edwin Gray and a Special Jury sat recently at Otley for the purpose of assessing the amount of purchase money and compensation to be paid by the Leeds Corporation to Mr. Jeremiah Thompson, of Otley, in respect of the compulsory acquisition from him of lands at Clifton-with-Newall, in the Washburn Valley, which are required by the Corporation. The farm in question consists of about 75 acres of land, with buildings thereon. Witnesses for the claimant assessed the value at £3640, while those for the Corporation estimated it at £2000. The award was £2963 9s.

Winding up an Ancient Company.—An important conclusion of one of the most ancient of Derbyshire Companies has been announced. A meeting of the Directors and shareholders of the Meerbrook Sough Company was held, to complete the sale of the assets to the Ilkeston and Heanor Water Board, who are spending £132,000 in taking the water to their respective districts in the east of the county. Mr. A. F. Hurt, J.P., presided; and the sale was duly completed for £5000. The only thing now remaining to be done is for the cash to be distributed among the shareholders. The Company was formed at the beginning of the last century to construct a sough to drain the water from the lead mines in the Middle Peak district, which were then yielding enormous profits. The water now running out of the sough totals some 14 to 18 million gallons a day; and there is an undergrouud lake in the hill where boats are sailed.

Tendring Hundred Water Company.—The annual meeting of this Company was held a few days ago in London—Mr. W. R. Dockrell in the chair. The report presented showed that the revenue had been £6814, against £5804 for the previous year—an increase of £1010. The total expenditure chargeable to the revenue account amounted to £4516, or an increase of £1735. The gross profit was £2784 12s. 9d., compared with £3022 17s. 8d. before; the reduction being more than accounted for by the reserve made in respect of old bad debts not previously provided for. After making provision for debenture interest, there remained a net balance of £1735 16s. 4d., against £2154 4s. 2d. last year. This being added to £393 10s. 7d. brought forward, made an available balance of £2129 6s. 11d. The Directors recommended that a dividend of 4½ per cent. per annum should be declared on the "A" shares, which, after deducting income-tax, would absorb £1684 12s. 4d., leaving £444 14s. 7d. to be carried forward. It was further stated in the report that the Tendring Hundred Water-Works Bill, 1901, passed through both Houses of Parliament without opposition, and had received the Royal Assent. The Walton Gas-Works (which are owned by a Company) required to be put on a profit-earning basis. The great expansion which had taken place in the Frinton-on-Sea and Walton-on-the-Naze districts, necessitated the erection of a water-tower and the laying of larger mains. The Directors expressed the opinion that these important works could no longer be deferred; and they announced their intention of shortly offering further capital, in accordance with the Act of last year, to meet such expenditure. The report was adopted.

LEGAL INTELLIGENCE.

The Affairs of the Old Sunlight Mantle Companies.

A curious side-light was thrown on the history of the promotion of the two old Sunlight Incandescent Mantle Companies by proceedings last week before the Court of Appeal. The question involved in the case was one of legal procedure only; but during the hearing some peculiar circumstances were mentioned by the learned Counsel engaged. The title of this case was "*In re* the Companies' Acts, 1862 to 1890, and *in re* The Sunlight Incandescent Gas-Lamp Company, Limited, Appeal of L. Morris from order of Mr. Justice Wright, Aug. 1, 1900." Mr. Leopold Morris was a shareholder and one of the Liquidators of the Company named; and he sought to review an order made by Mr. Justice Wright dismissing an application made by another Liquidator, Mr. C. F. Kemp, against two of the Directors, Mr. Duncan and Mr. Wethered, and asking that they might be made liable in certain sums. The Company, it appeared, was incorporated in 1895 as a small concern for the purpose of acquiring a patent for making incandescent gas-mantles, which it was thought might, or might not, be an infringement of the Welsbach patent. The idea was that if it proved not to be an infringement, a much larger Company should be formed to work it. The capital was £5000 in £5 shares Shortly after the Company was incorporated, an action for infringement of patent (as was anticipated) was commenced by the Welsbach Company; and in April, 1896, Mr. Justice Wills dismissed it—holding that the Sunlight mantle was not an infringement. The Company then set about the promotion of the contemplated larger Company; and further capital was subscribed. On May 12 the prospectus of the new Company was issued; it being proposed that the new Company should purchase the old Company's patent for a large sum, which was to be payable if and when any appeal of which the Welsbach Company had given notice was decided in favour of the Sunlight Company. It was thereupon arranged by the Directors to insure against the risk of the appeal being decided adversely to the Company; and an underwriting policy to the amount of £10,000 (at 20 guineas per cent.) was effected. Mr. Duncan, the Chairman, "took a line" to the amount of £2000, and Mr. Wethered, another Director, £1000. This was completed on May 29; and a cheque for £2100 was paid by the Company to the broker who had managed the transaction, and who divided it among the various underwriters. Mr. Duncan received £420 and Mr Wethered £210; and it was repayment of these sums which the Liquidator now claimed. On June 9, the Welsbach Company abandoned their appeal; and shortly afterwards the new Company completed the purchase of the patent, and the old Company went into voluntary liquidation on Jan. 12, 1897. Two Liquidators were appointed—Mr. Morris and Mr. Belcher; but the latter retired when it was found that questions as to Mr. Duncan's liability might arise. Mr. Fraser was thereupon appointed in his place. Mr. Morris and Mr. Fraser, however, took different views as to what ought to be done with regard to pressing certain claims against the Directors; and ultimately, in Nov., 1899, Mr. C. F. Kemp was appointed a third Liquidator, with the special duty of investigating the questions on which a difference of opinion had arisen between the other two Liquidators. By a further order of the Court, on March 24, 1899, Mr. Kemp was empowered to take such proceedings as he might be advised. Thereupon a summons was issued by Mr. Kemp seeking repayment by the two Directors named of the sums received by them on the underwriting contract; but it was dismissed on Aug. 1, without costs. Mr. Morris, not being a party to the summons, had to obtain leave to prosecute the appeal—as a party interested; and that leave was given. He now asked permission to put in further evidence. This, however, after some discussion, was refused.

A Water Diviner Sued for Breach of Contract.

At the Ipswich County Court last Wednesday, before his Honour Judge Eardley Wilmot, Miss Ellen Pritty sued Mr. Sydney T. Child, a miller and water diviner, for £50 damages for alleged breach of contract to find water on her property at Cretingham. It was stated on behalf of the complainant that the defendant gave the depth of 25 feet at a particular spot as that at which water would be found. A well was sunk, and 25 feet was reached without finding water. Miss Pritty then wrote to defendant that she was disappointed. The well was sunk to 48 feet, and bored a further 16 feet—the total depth being 64 feet—without water being found. The well was then abandoned, and Mr. Child indicated the spot where another should be sunk; and again he said water would be met with at about 20 feet, whereas none was found at that depth. For the defendant, it was submitted there was no case for him to answer. He was an adviser and expert, and could not be said to guarantee the success of his advice. His contract was not to find water, but to show a place where he thought it would be found. Even assuming that there was a contract, it was suggested that it could hardly be contended that for a payment of 25s., and bearing his own expenses, he could guarantee to indemnify Miss Pritty for an expenditure of something like £60. If Miss Pritty had chosen to go on digging wells, the cost might have amounted to thousands. If there was a contract, Miss Pritty must show negligence on defendant's part before she could recover. He had been finding water for 35 years, and had advised in nearly 1000 cases, in none of which had he received any complaint. His Honour, in giving judgment for the plaintiff for £42 6s. 8d. (the cost of the first well), said the question was whether any definite statement was made by the defendant as to the depth at which water would be reached. He found that such a statement was made in a reckless way. With regard to the second well, he did not find in favour of the plaintiff, as it was probable the defendant was more prudent in his statements after finding himself so hopelessly wrong in the first instance. He accordingly gave judgment for plaintiff for the expenses in respect to the first well, with costs. Defendant's Counsel (Mr. Rowley Elliston) asked his Honour if he found that Mr. Child was negligent in regard to the exercise of his powers. His Honour: He was negligent in his reckless statements. It is not a question of negligence. Mr. Elliston said the statement was not made

until after the contract was completed. After further legal argument, his Honour gave defendant leave to appeal on the points of law raised by his Counsel.

Curious Action Against a Water Company.

An action has been recently tried at Droitwich, in which Mr. John Green sued the East Worcestershire Water Company for £21 damages caused by the fitting up of a defective hot and cold water service at his residence. It appeared that in October, 1898, the Company undertook to lay a service of water to the house, and also supply a proper hot and cold water service, for £38 and £28 16s. respectively. The work, however, was very badly done; and in a short time numerous leaks were found in the pipes leading to the pantry, which became flooded. Noises of an alarming character were heard when drawing hot water; and owing to the construction of the boiler and steam-pipes it was impossible to obtain a cold bath, the hot-water pipe running close to the cold store. Finally a new hot-water service had to be put in, at a cost of £16. Plaintiff claimed this amount, together with £5 for inconvenience and loss. For the defence, Mr. Skinner, the Engineer and Manager of the Company, who was responsible for carrying out the contract, said that plaintiff was frequently complaining without cause. The reason of the noise was that plaintiff omitted to have the boiler and supply-pipes properly cleaned periodically. The Jury gave a verdict for the plaintiff for the full amount claimed.

An Amateur Photographer's Water Supply.

A test case of some importance came before the Magistrates at the Wilmslow Police Court on Thursday last, when Mr. John Wright, an amateur photographer, was summoned, at the instance of the Stockport Corporation, for non-payment of a water-rate amounting to £4 6s. Mr. Acton (who appeared for the defendant) said that the summons called upon his client to show cause why he had not paid the water-rate within 14 days of the receipt of the demand note. Mr. Wright a fortnight ago gave two reasons for non-payment. The first objection was as to the charge of 10s. for amateur photography; and the second was that the Stockport Corporation were under statutory obligations to supply pure and wholesome water, sufficient for domestic purposes, and that they had notoriously failed to supply such water. With regard to the first objection, he contended that the Corporation had no right to make any extra charge for amateur photography as distinct from water to be used for domestic purposes. Up to 1893, Mr. Wright had a supply from a well in his own garden. In that year, he applied to the Stockport Water Company, who were the predecessors of the Corporation as far as the water supply was concerned. He had an interview with Mr. Robinson, the Engineer of the Company; and, among other things, he asked whether amateur photography came under the heading of "domestic purposes." Mr. Robinson said that it was not treated as an "extra." At the time Mr. Wright signed a form, a material point of which was that if the water was wanted for the purpose of trade, or for water-closets, baths, or garden, or any other than domestic purposes, it must be so stated. No mention was made of amateur photography with regard to an extra charge being made; and from 1893 to 1899, no such charge was made. In the latter year, the Corporation took over the Water Company. It was a very significant thing that when the Corporation had acquired the business, the first two demand-notes contained no extra charge for amateur photography; but on Feb. 5 a demand-note was sent in for 5s. for amateur photography, as an extra charge for the half year. In July last, when the next demand-note for the water-rate was sent in, there was appended another demand for an extra charge of 5s. for amateur photography, and arrears 5s.—amounting in all to £4 6s. By section 11 of the Stockport Corporation Act of 1899, they were bound by agreements that were previously made with the Water Company; and Mr. Wright had made an agreement, which was acted upon for six years, and under which the predecessors of the Corporation made no extra charge for amateur photography. Under these circumstances, he contended that amateur photography could not be held to be an extra distinct from domestic purposes. Alluding to the second objection, Mr. Acton said that he should call evidence to show that the water was unwholesome and impure—indeed, it was a scandal and a disgrace Evidence was then given by Dr. Burghardt that the suspended matter (oxide of iron) in the water was 28 parts in 100,000. Mr. Dobson (on behalf of the Corporation) admitted incrustation, and said the bad condition of the water was due to some defective mains which were being repaired at the time the water was drawn With respect to the extra charge for amateur photography, at the time the Act was passed such a thing was not in existence. The Corporation were doing all they could to remedy the unsatisfactory condition of the water, and on the best-known principle. Had it not been for the drought, the work would have been completed. The Magistrates decided that the Corporation were not entitled to recover the charge for amateur photography, and accordingly made an order for the payment of £3 16s. Under the circumstances, however, they declined to order anything except ordinary costs. With respect to the water, the Chairman added that the Bench were of opinion that the Corporation had not supplied such pure and wholesome water as they might, and that they had not carried out their statutory obligations to filter and soften the water within the two years specified.

The Abolition of London Smoke.—Sir W. B. Richmond has written to "The Times" to announce that the first public meeting of the Coal Smoke Abatement Society is to be held, by permission of his Grace the Duke of Westminster, at Grosvenor House, to-morrow afternoon, on which occasion he will bring before the public the fact that, whereas the Public Health Act of 1891 was practically a dead letter until the Society took action in regard to it, it is now, through the energy of their two Inspectors, taken cognizance of; and the Society believe that, if the public will give them their help, "London will be cleared of half the offensive smoke which lies between the city and purer light."

MISCELLANEOUS NEWS.

FURTHER POWERS FOR THE COMMERCIAL GAS COMPANY.

The Commercial Gas Company have given notice, in accordance with the intimation made at the last half-yearly meeting, of their intention to apply to Parliament for further capital and other powers. It is proposed to consolidate or convert the existing stock, and prescribe the rate of dividend to which it shall be entitled; also to alter, define, and regulate the capital and the rights of the holders thereof, and to bring into operation any unexercised power to raise capital. The debenture stocks are likewise to be consolidated into one stock of such nominal amount, and at such rate of interest, as may be defined in the Bill. Additional capital will be applied for. The illuminating power and the price of gas are to be altered, in the manner set forth in the following clause in the notice:—

To reduce or alter or make provision for the reduction or alteration and the variation from time to time of the illuminating power of gas to be supplied by the Company and of the standard price to be charged therefor, and to vary and prescribe the standard rates of dividend payable by the Company on their several classes of stock, and to provide for the decrease or increase of such standard rates of dividend respectively in correspondence with the increase or decrease from time to time of the price charged by the Company for gas to be supplied by them above or below the standard price to be fixed by the intended Act, and to repeal or vary the provisions or some of the provisions relating to illuminating power, standard price, and standard rates of dividend of sections 52 and 53 of the Commercial Gas Act, 1875.

The Company will seek authority to purchase and hold further lands for the purposes of their undertaking, as well as to dispose of land already acquired. It is proposed to amend the provisions of section 58 of their Act of 1852 with regard to the time for holding the ordinary meetings, and to make certain changes incidental thereto. The scale of voting of proprietors, and the qualification of Directors and Auditors, are to be altered; and special provision is to be made in respect of the "issue, sale, or transfer of any shares or stock to consumers of gas supplied by, or to persons in the employ of, the Company." The Bill to be promoted will contain clauses to allow of the nomination of transferees, in certain cases, and of the payments to nominees without the production of probate, &c., or certificate of payment of estate, succession, or legacy duty. It is intended to provide for agreements being entered into by employees of the Company for the acquisition of an interest in the profits of the undertaking, and for sanctioning any agreements which have been already made; and such instruments are to be exempt from stamp duty. Authority will be sought to manufacture, supply, &c., stoves, engines, and other appliances, including "meters and apparatus for the automatic supply of, and payment for, gas," as well as for any purpose for which gas may be utilized; likewise to fix, remove, or alter them, or any other fittings or apparatus, or to do any work in connection therewith. The provisions of the Company's Act of 1875 are to be extended to the above-mentioned articles supplied by the Company; and also altered, if necessary, to make further provision for the auditing of the accounts.

THE BIRMINGHAM GAS-WORKS SCHEME.

Adoption of the Committee's Recommendations.

As arranged, the Birmingham City Council met again last Tuesday to continue the discussion of the proposal made by the Gas Committee regarding the purchase of a site whereon to carry out as required a complete gas-works. The site comprises 108 acres of land, with buildings; and the price is £15,500. It will be remembered that the matter was introduced at the Council meeting on the 9th inst.; and the proceedings, as far as they were carried, were reported last week.

Mr. WALTHALL moved an amendment to the adoption of the Committee's recommendation in the following terms: "That, having regard to the definite statement made to this Council by the Gas Committee in their report of May, 1900, that the sum of £500,000, then authorized to be borrowed, would meet the requirements of the undertaking for the next ten years, the present proposal be referred back for further consideration." In a speech of considerable length, Mr. Walthall stated that he was beginning to be seriously alarmed at the way the Gas Committee had been doing their work for some time past. It was often thought that the department, because it was not a burden on the rates, should have more latitude than was allowed to any ordinary Committee whose work was directly chargeable to the rates. The result of this latitude, however, might be unsatisfactory management, an increased price of gas, a greater amount of money spent, and less profit to the rates. The reports of the Committee and the speeches of the Chairman had led him to the conclusion that the present scheme was unnecessary. In February, 1898, the Council were told by the Committee that up to 1902 £366,000 would be required, and that this would be sufficient to provide for increased demands to the winter of 1905-6. This estimate was based on 5900 million cubic feet of gas per annum being required; while, as a matter of fact, the result had been a little less. The £366,000 included the reconstruction of the Windsor Street and Adderley Street works at a cost of £200,000, and other matters. Without a doubt there had been an increased consumption; but the Committee had up to now met that without dealing with the proposed expenditure of £200,000. The present report referred to the report of February, 1898. But important reports had been brought forward since then; and the Committee had received the Council's sanction to borrow £500,000—sufficient to carry them over the next ten years from May, 1900. The Lord Mayor stated that, if the land was purchased, it would be all the land that would be required for the next twenty-five years; but the Council were not informed what the requirements of the Gas Department would be for the next twenty-five years. The period of twenty-five years was new to the Council; but a perusal

of the report would show that £500,000 would be required during the next ten years. The same facts, figures, and arguments were used in May, 1900, to obtain £500,000 as were employed in the report now presented. Last year the Committee said £500,000 would be sufficient for the next ten years; but to-day they said for the same period they wanted a further £500,000 [Dissent], so that what they really wanted was £1,000,000. Considering the proposed extension of the electric lighting, the Gas Committee had no right at all to look longer ahead than ten years for their consumption; and if in May, 1900, the Committee were given all they required to last them ten years, they had received all they ought reasonably to require. A report by the Committee in October last would lead every member to suppose that the Committee were quite satisfied with the money the Council had granted them, and that they were carrying out the report which they presented in May, 1900. Instead of this, however, within three weeks the Council were confronted with this large scheme, to the consideration of which the Committee seemed to have given scant attention. One reason adduced in the report for the proposal was the increase in the consumption, and that there would be 4½ per cent. increase during the next ten years. This statement was somewhat misleading; the increase for 1900-1 having been only 2 per cent. —a smaller increase than for any of the preceding seven years. The report also spoke of the increasing demand for gas for power and heating purposes; but in spite of the opposition of the Committee, the Mond gas people were successful in obtaining powers to supply in the Darlaston and Wednesbury districts. Then there was the extension of the electric light, which no doubt would be brought about, and which would have an effect on the demand for gas. The Lord Mayor said the growth of the gas undertaking was the reason the scheme should be adopted; but there was no such increase and no such profit as the Gas Committee would have them believe. In 1876 there was a surplus profit of £34,122; and the quantity of gas then sold was 2386 million cubic feet. But last year, when the amount sold was double, the profit was only £544. It might be said the price of gas was different, but in 1889 the average price was the same as last year. Then, however, there was not the same output; but £70,000 was paid in reduction of the rates. [Alderman CLAYTON: What did coal cost?] He opposed the scheme as a whole. They were told the land was cheap; but he was informed that the property was put up for sale a few weeks since, and withdrawn at £10,000. His contention was that the expenditure was unnecessary at the present time.

Mr. DEXTER, in seconding the amendment, said he considered that Mr. Walthall had made out a good case for the further consideration of the matter by the Committee. He was informed that the Erdington District Council were seeking electric lighting powers; and they would not require gas for their district. Sutton had also powers and plans prepared for supplying their area with electric light. The land was very cheap; but this was not the time to ask for new works.

Alderman EDWARDS, to prevent a wrong idea as to the price of the estate, mentioned that about half of it was bought in at a recent auction for £10,000. The present purchase by the Committee was for the whole estate of 108 acres; and, with one exception, it was the cheapest land he ever remembered the Corporation purchasing.

Alderman Sir JAMES SMITH said the mover of the amendment had made the initial mistake of confusing the question of the purchase of land with that of building upon it. It did not follow that the Committee would begin to build at once; that would only come when the necessity arose. At the present time, the rentals from the ground would nearly cover the interest and sinking fund. As to Mr. Walthall's criticism of the gas profits, he should have taken into account the increased cost of coal, and the relatively small increase which was made in the price of gas. He thought the vote of the members of the Council should depend upon their confidence or otherwise as to the continued future successful working of the gas undertaking. The Committee were good business men; and he believed in their judgment as to the necessities of the case. In going over the gas-works occasionally, it had always struck him how well managed they were.

Mr. LANCASTER remarked that, as to the price of the land, there could be no two opinions; but he should like to know more before voting for £500,000 being inserted in the Bill.

Mr. HARRISON BARROW said Mr. Walthall had very incompletely quoted from the speech of the Lord Mayor last year, when it was explained that the Committee had had no increase of capital since 1883, when the gas sold was only half what it was now, and the capacity of the works had been enlarged by 100 per cent. The proposals of 1898 were based on very careful estimates of their Engineers, and there was no need to alter those estimates; but they found that by 1905-6 they would have very little land left at Nechells for future extensions. This being so, it was necessary that they should look out for land to meet the requirements at that date. The site before them was cheap; it was admirably situated for gas-works; and it would be a pity if the opportunity of securing it was lost. Respecting the proposed powers to borrow £500,000, Mr. Walthall seemed to be under the impression that the Committee wanted to spend this sum all at once. All they really wanted was the power to raise the money; and before commencing to erect works, the proposals of the Committee would be fully reported and the sanction of the Council obtained. As to there being no contribution to the rates from the gas undertaking last year, this was only in accord with what the Committee said would be the case when they raised the price of gas by 3d. instead of a larger amount. Regarding the growth of the gas consumption, it was true that last year the increase was only 2 per cent.; but Mr. Walthall omitted to state that in the last half year the increase was at the rate of 3·54 per cent., or nearly approaching the normal 4 per cent. The reason for the temporary check was the higher price.

Mr. KELLY, looking at the proposal from a ratepayer's point of view, strongly opposed it.

Mr. BISHOP assured the Council that, on the question before them, there was absolute unanimity among the members of the Committee. It was not true, as Mr. Walthall had suggested, that the idea had only arisen in their minds during the last few months. They had for several years been looking out for land for future works. The Committee were under statutory obligations to supply gas to the gas area; and it was necessary for them to look, not five years forward, but twenty years. If they were to wait until 1905 before looking for land, and then began their search, they would probably find it all gone. This site was almost the last available plot of land within three or four miles. A year ago they lost another piece through it becoming known that it was wanted by the Corporation, and too high a price being put upon it. The Gas Department had paid £678,452 in solid cash to the relief of the rates since the undertaking had been in the hands of the Corporation; and he had every belief that its remunerative character would not cease.

Mr. BALDEN deprecated the growing custom of members of a Committee privately buying a piece of land, and then reporting to the Council that they had done so. The practice was calculated to bias the Council's vote, instead of judging a scheme upon its merits. He, however, supported the Committee.

Mr. TOLLER observed that a new retort-house had been built at Saltley; and the Gas Committee did not need the land at Erdington. In his opinion, there was great waste at the gas-works, which, under private management, would not be tolerated for an instant. He had heard that the new retort-house at Saltley was a failure, and that the one erected at Windsor Street about twenty years ago, at a cost of £500,000, was unsafe to work in, and would have to come down.

Mr. STEVENS recalled a Christmas Eve, seven or eight years ago, on which, at midnight, the Gas Committee had only four hours' supply at their command. It would be a calamity if, by failing to prepare for the increasing demand, they had the city left without an adequate gas service. In the matter of the amount of profit to go to the relief of the rates, he hinted that there might be a "surprise packet" in store for next year.

Mr. STEMBRIDGE considered it only reasonable that the Council should have more information with regard to the £500,000 additional capital authorized in May, 1900. He admitted, however, that the land was cheap.

A few other members added to the discussion.

The LORD MAYOR, in reply, said a suggestion had been made that the Committee were guilty of a trick or a blunder in omitting to mention authority which was given in 1900 to borrow £500,000. This sum was partly to defray an expenditure of £366,000 which had been authorized in 1898. It was a corollary to the latter vote. The one sum included the other; and the two therefore should not be added together, as had been done in the present instance. The forecast made last year had reference to the ordinary additions to capital expenditure for such matters as new mains, &c., but was insufficient to meet such a matter as a site for new works. He submitted that, if the Gas Committee did not make provision for the future, they would incur a grave responsibility, and that in view of the delay which must in any case take place before the land could be actually built upon, they were none too early with the present recommendation.

The amendment was lost by 55 votes against 7.

The LORD MAYOR then moved that the land referred to in the preceding resolution, together with the site of a public-house on the west side and a strip of land on the east side containing about 12 acres, should be scheduled in the Birmingham Corporation (General Powers) Bill, 1902, for gas-works purposes, and that the Corporation should be authorized to raise a further capital sum not exceeding £500,000. He said the strongest argument in favour of raising further capital was a survey of the past twenty-five years. The undertaking had worked exceedingly well, and had answered expectations. At the outset the capital was £2,084,000, and they had only increased it to £2,457,000; so that in twenty-five years they had, by skilful management and care, increased the capital by less than £500,000.

Alderman LAWLEY PARKER seconded the resolution.

Mr. KELLY, again speaking in the name of the ratepayers, opposed.

Mr. NETTLEFOLD said that sometimes the criticism of the Gas Committee was not quite fair. In July, 1899, the Council decided that the price of gas should be raised 3d. per 1000 cubic feet. But the average increase in other parts of the country was 6d.; and if 6d. had been the increase in Birmingham, there would have been a profit to the rates of something like £63,000. This was a striking example of the difficulty of successful management of commercial enterprises by means of a corporate body. The Committee contained some of the ablest members of the Council; but the Council were responsible for only increasing the price of gas by 3d., and thereby reducing the profit to the rates. As to the competition between gas and the electric light, he said that one of the largest firms in the district had to buy their gas and make their electric light; and they found at present that it was more efficient and more economical to substitute gas for electric light for many purposes.

Mr. MURRAY remarked that at Liverpool, where the Corporation owned the electric light works, they had decided not to extend the use of electricity for street lighting, but to put up more incandescent gas-burners. The same thing might be said of Newcastle-on-Tyne; and this was a justification for the decision the Gas Committee had arrived at in the report presented that day.

The discussion was carried on by several other members.

The LORD MAYOR, in reply, observed that the statement made by Mr. Nettlefold respecting the increase in the price of gas was perfectly correct. If the Council had wanted a greater profit, it would have been easy to increase the price by 5d. or 6d.; but they preferred less profit, and an increase of 3d. only. He hoped that the Committee would be able to offer the usual amount in reduction of the rates next year.

The resolution was agreed to—50 votes being recorded for it and 5 against it. Two members were neutral.

The adoption of the report was then moved by the LORD MAYOR, seconded by Mr. STEVENS, and agreed to.

Uckfield Water Company.—An extraordinary meeting of this Company was held on Tuesday last, for the purpose of considering and approving an application to the Board of Trade, under the Gas and Water Works Facilities Act, 1870, for a Provisional Order for power to raise additional capital, to extend the existing limits of supply, and for other purposes. It was unanimously resolved that the Directors should take the necessary steps to obtain such an Order.

POWER-GAS CORPORATION, LIMITED.

The Statutory Meeting of this Corporation was held on Tuesday last, at the Westminster Palace Hotel—the Right Hon. Sir HENRY H. FOWLER, G.C.S.I., M.P., in the chair.

The report, which was presented pursuant to section 12 of the Companies Act, 1900, stated that the number of ordinary shares allotted was 235,715. Of these, 52,177 were allotted as fully paid, in consideration of the transfer to the Corporation of 1900 fully paid £10 preference shares, 318 fully-paid £10 ordinary shares, and 4000 £10 ordinary shares, with £7 10s. paid up, in Ashmore, Benson, Pease, and Co., Limited. The remaining 183,538 ordinary shares in the Corporation had been allotted wholly for cash; and the amount so far received in respect of these was £45,872. The receipts and payments of the Corporation on capital account were as follows: Receipts (application and allotment), £45,872; payments, *nil*. The preliminary expenses (including registration fees) were estimated to amount to £6200.

The SECRETARY (Mr. Herbert Bedford) having read the notice convening the meeting,

The CHAIRMAN said this was a purely formal meeting, held in accordance with the Act of Parliament, which required that within three months of the Corporation commencing business a meeting should be held for the purpose of reporting the progress made up to that time. It would be seen from the report that the ordinary shares had been allotted, that the total amount received upon them was £45,872, and that the preliminary expenses were estimated (as was stated in the prospectus) to amount to about £6200. All he had to say to them was that the Directors had been very much occupied since they commenced business in organizing the Corporation, and in making the necessary alterations for the development of the works which were acquired when the Corporation was formed. There were applicants for a great many more shares than the Directors could allot; and the number of proprietors in the Corporation was between 580 and 600. The Board were quite satisfied with the progress made; and when the meeting was held at the close of the first year's operations, they would be in a position to give full and complete information as to the work accomplished and the future prospects. He had at present merely to say that the Directors were perfectly satisfied with what had already been done in the way of organizing the business, and in obtaining orders for the various objects for which the Corporation was formed.

Mr. ERNEST CREWDSON, in moving a vote of thanks to the Chairman, said that, of course, this was little more than a formality on the present occasion, for the business had been neither difficult nor long; but he thought the Corporation were to be congratulated on having so distinguished a Chairman, and one who, should occasion arise, when there were more difficult meetings to conduct, would be able to bring his ripe experience to his aid. He thought the undertaking was one which had been brought out under most promising auspices.

Mr. MYERS seconded the motion.

A brief reply by the CHAIRMAN concluded the proceedings, which had occupied altogether about five minutes.

MANAGEMENT OF THE ARBROATH GAS-WORKS.

Petition by Citizens.

A Meeting of the Arbroath Gas Corporation was held last Thursday—Provost GRANT in the chair—to consider a petition by citizens relative to the management of the gas undertaking. The Clerk (Mr. David Chapel) read a letter from Mr. James Jack, a chemist in the High Street, enclosing the petition, which had reference to the position of the Gas Manager (Mr. R. S. Carlow). It set forth that the signatories had known Mr. Carlow for more than twenty years, and that they believed that during the greater portion of this period he had done good service for the community, and that it had only been lately that the Corporation had occasion to call his conduct in question. They hoped the Council might see their way to give him another chance to retain his position for such a probationary period as they might consider expedient. The petition was signed by a large number of prominent men connected with the town; but, as one member of the Corporation remarked, not a single working man had apparently put his name to it. Bailie Duncan said that, as the mover of the motion which had been carried at their recent meeting, he begged to propose that the petition be not received. He did not wish to stop or burke discussion on the question, but he submitted his motion on the broad principle that to accept such a petition was contrary to the spirit in which public business ought to be conducted. Rather than agree to the reconsideration of Mr. Carlow's position, he would efface himself as a town councillor. Mr. Napier seconded the motion. Mr. Thomson thought Bailie Duncan had taken a very extreme view of the petition. It did not ask the Corporation to resile from what they had done, but simply to give Mr. Carlow a chance. He proposed, as an amendment, that the Corporation should take the petition into serious consideration; and he also gave notice that at the next meeting of the Corporation he would move that they delay taking steps towards the appointment of a new Gas Manager. Surely, if Mr. Carlow was fit to take charge of the works for two months, he was able to continue in the management for a few months longer—at least until the time when the annual balance was struck. If they agreed to this, they would be giving Mr. Carlow a chance of getting another managership; but if they peremptorily required him to leave, they would simply be damning him for life. Mr. M'Wattie seconded the amendment on the broad ground of leniency and mercy. There was, in his opinion, contributory negligence on the part of the Corporation Committees in not supervising Mr. Carlow as they ought to have done. Mr. Smith said that neither he nor the members of the Corporation who agreed with him wanted to do Mr. Carlow an injury, but at the same time they did not want to do an injury to the community. Mr. Carlow might, as had been stated, have done valuable services to the community in his time; but it could not be said that he had been doing so during the past two or three years. Mr. Lorimer supported the motion. He said that no judges could have given a decision more impartial than the Committee of Investigation had done. As a matter of fact, the Committee had done everything in their power for Mr. Carlow. Bailie Melvin said he had as much sympathy with Mr. Carlow as any one at the Board. At the same time, they were sent there to do their duty to the public and to serve the interests of the public. Mr. Thomson said his amendment only proposed that they should consider the petition, and he certainly would not withdraw it. Bailie Duncan having replied, a vote was taken, when the motion was carried by 13 votes to 3. It was then remitted to a Special Committee to take steps to obtain a new Manager, and to appoint an interim foreman of the works.

OUTDOOR LIGHTING BY WELSBACH BURNERS.

The Metropolitan District Railway are evidently well pleased with their experiments in the use of Welsbach burners and mantles for lighting their stations; for they have resolved upon substantial extension to some of the busiest of the stations. Presently it will be found that the whole of them from the Mansion House to Sloane Square (inclusive) and Earl's Court are fitted with ordinary Kern burners—platforms, entrances, offices, &c., complete—just as the Westminster Bridge station has been for some time past. We are hoping to see the improvement carried all round the circle. The use of incandescent lighting in underground London in this way is extremely interesting, and that it should be a success is highly gratifying. Not only are the lights subject to considerable and almost constant vibration by the frequent passing and stopping and starting of trains, but, as users of the underground lines are aware, the atmospheric conditions are not of the best—the air being, as a rule, laden with soot and dust, which cannot be of any assistance to the mantles in showing their best behaviour. Public lighting, too, on this system continues to spread. The Welsbach Company have secured an order for 130 lanterns for Cambridge; and a contract for lighting the new Corporation markets at Bury with high-pressure burners and Keith's compressors. This order was obtained in competition with electricity. The Ealing District Council have decided to put up another 100 Kern burners; and negotiations are pending for an installation of intensifying burners for the Chiswick District Council. These are only examples of the outside work which the Company have in hand at the present time. But they are sufficient to indicate that the subject of incandescent gas lighting for street illumination continues to attract local authorities in different parts of the country. The system, in fact, is extending daily; and gas suppliers should bear in mind that every really well-maintained outdoor incandescent lamp makes a striking advertisement.

SALES OF STOCKS AND SHARES.

The sale which Mr. Alfred Richards conducted at the Mart, Tokenhouse Yard, on Monday last week, was of a specially interesting character, inasmuch as it consisted of no less than five fresh issues of stock by order of the Directors of the Barking, Grays, Harrow and Stanmore, and Ilford Gas Companies, and of the South Essex Water Company. The Ilford Company's issue was the most important—consisting of £5000 of ordinary "C" stock and a like amount of 4 per cent. perpetual debenture stock; and it was submitted by Mr. Richards in conjunction with Mr. W. Ashmole, of Ilford. The Company's "C" stock ranks for a standard dividend of 5 per cent., subject to the sliding-scale; and it is entitled, in view of the dividends paid by the Company since 1897, to 6 per cent. per annum. The stock was offered in £100, £50, and £20 lots. The first fetched £120, £120 10s., and £121 each; the second, £60, £60 10s., and £61 each; and the third, £24 and £24 10s. each. The 4 per cent. stock was similarly parcelled; and the £100 lots fetched £101 5s. and £101 10s., the £50 lots £51 and £51 2s. 6d., and the £20 lots from £20 5s. to £20 15s. each. The new issue of the Harrow and Stanmore Company consisted of 300 £10 "C" shares, ranking for a standard dividend of 7 per cent., subject to the sliding-scale; the last dividend on similar shares having been at the rate of £5 12s. per cent. per annum. They were put up in lots of ten and five, and fetched £10 17s. 6d., £11, and £11 5s. per share. The Grays Company made a new issue of £10 "B" (7 per cent.) shares; the last dividend on similar shares having been at the rate of £4 18s. per cent. per annum. There were 200 sold, at £10 apiece. An issue of 400 £10 ordinary shares in the Barking Gas Company, carrying a maximum dividend of 7 per cent., and ranking *pari passu* with the original shares (on which 5 per cent. has lately been paid) up to this amount, was disposed of at par. The South Essex Water Company issued £5000 of 5 per cent. ordinary stock, under the powers conferred on them by their Act of last session. In view of the last dividends paid on the existing capital, it will be entitled to a proportionate dividend at the rate of 4 per cent. per annum. It was sold at the rates of £105, £105 10s., and £106 per £100 of stock. There was keen competition for several parcels of shares in the Eastbourne Gas Company, offered for sale by auction last Wednesday by Mr. J. C. Towner. Original £10 shares realized £34 each, while "B" shares of similar face value fetched £24 5s. each. At the Sun Hotel, Kingston, the next day, Mr. G. F. Page sold some £100 lots of the new consolidated ordinary stock of the Kingston Gas Company at £120 each, and a £50 lot for £60. At Durham last week, Mr. E. Pounder sold some £10 shares in the Spennymoor Gas Company at prices ranging from £10 7s. 6d. to £11 7s. 6d. apiece. In consequence of the unfortunate trade outlook in the district, owing to the prospective closing of the Tudhoe Iron-Works, the bidding was anything but brisk, and the shares were sold for much below their market price. By order of the Directors of the Gloucester Gas Company, Mr. H. Knowles offered for sale at the Company's offices, on Friday afternoon, £5000 of new consolidated ordinary stock of the Company, ranking for a maximum dividend of 5 per cent. per annum. There was a good attendance of bidders, and the whole of the 50 lots of £100 each were disposed of at prices ranging from £115 to £118 10s. per £100 of stock. The total amount realized by the sale was £5814 10s., which works out to an average of £116 5s. 9·35d. per cent.

ALTRINCHAM GAS-WORKS EXPLOSION.

The Town in Darkness.

While operations were being carried out in connection with the putting down of some new apparatus at the Altrincham Gas-Works, on Thursday last, an explosion occurred in the retort-house, as the result of which the main conveying the gas from the retorts was torn open. Two men were injured, though not seriously; and considerable structural damage was done—the syphon-box being blown into the boiler-house. As the result of the injury to the main leading from the retorts, the supply of gas was shut off from the town at night—the gasholders having previously been reduced to the lowest possible level for the purposes of the extensions which were being carried out. A warning was promptly issued by the Gas Company, to the effect that there would be no gas available that night; and the result was a great rush on oil and candles on the part of the consumers. Near the railway station fires were lit, to show people their way home; and for once in a way the customers of the local Electric Supply Company had real cause to congratulate themselves. It was anticipated that the trouble would be at an end on the following day (Friday); and this proved to be the case.

LIGHTING DISPUTE AT COCKERTON.

Some time ago a question arose between the Darlington Corporation and the Cockerton Parish Council as to the price to be charged for the public lamps in the Council's district; and this has now resulted in the gas supply being cut off. In 1895, when Cockerton adopted the Lighting and Watch Act, they entered into an agreement with the Darlington Corporation to light the streets at a charge of 35s. per lamp, inclusive of the cost of lighting and extinguishing. The arrangement worked smoothly until about a year ago, when the rise in the price of coal made the production of gas more costly. Thereupon the Corporation increased their demand upon Cockerton to 50s. per lamp. Cockerton first offered to pay 40s., and, when this was refused, 45s. per lamp. Darlington, however, would accept nothing less than 50s.; and hence the present deadlock. The "Northern Echo," in placing the views of both sides before its readers, says that there are 14 lamps in the village, which are reckoned to consume about 6000 cubic feet each in the lighting season—that is, from dusk till 11 p.m. for eight months in the year. At the charge of 35s. per lamp, the annual cost has been £24 10s. But, in addition to this, the village pays 10 per cent. in respect of the new main, which brings the total lighting cost up to £25 5s. 5d. With a charge of 50s. per lamp, the total cost to the village would work out to £36 15s. 5d. a year. It is argued that a consumption of 6000 cubic feet, if charged at the same price as is paid by private consumers, would cost 16s. 6d.; and an additional 14s. 6d. would cover the lighting and extinguishing. Accepting these figures as correct, there would, at the proposed charge of 50s., be a profit to the Corporation of 19s. per lamp. On the other hand, it is pointed out that Cockerton, according to contract, was paying much less for its gas while, owing to the high cost of coal, the price to Darlington consumers was increased; and it was therefore only fair, at the revision of the agreement, that Cockerton, although the price of coal had meanwhile come down, should contribute something of what the Corporation had previously had to pay. As neither side will give way, there is every prospect of the Cockertonians being obliged to grope their way about in darkness during the coming winter.

CHARGING STREET LIGHTING IN PUBLIC ACCOUNTS.

The audit of the accounts of the Sowerby Bridge District Council by Mr. M. D. Propert, on behalf of the Local Government Board, which concluded on the 8th inst., furnished some features for criticism. Certain items were objected to by Mr. J. W. Lodge, a former member of the Council, who stated that he appeared for other ratepayers as well as for himself. There were present: Mr. A. Clay, J.P., Chairman of the Council; Mr. F. Clay, the Chairman of the Gas Committee; Mr. R. W. Evans, the Clerk; Mr. J. Marsland, the Gas Manager and Secretary; and Mr. J. Barraclough, the Accountant. Mr. Lodge's chief cause of complaint was in respect of the public lighting. He said the cost of lighting and the erection of street lamps and pillars in Sowerby Bridge was provided for by the gas undertaking. In their Act was a clause which gave them a differential price; they could charge 10d. more per 1000 cubic feet to the outside districts. At first the price was 5s. for outside districts and 4s. 2d. for the inner area. The difference became heavier as the price lowered; for it stood to reason that 10d. on 3s. 2d. was heavier than 10d. on 5s. Not only this, however, but the outside districts had been mulcted with part of the cost of lighting Sowerby Bridge. To light the streets at the expense of the Gas Committee was also an injustice to the consumers who were not ratepayers. It was an injustice to many of the large ratepayers, too, because they used electricity. Mr. Clay said he agreed with Mr. Lodge that the public lighting ought not to be charged to them. The Auditor asked why it had been done so long; but no one could give him an answer. Mr. Lodge said he had brought the matter up in the Council four times, and could never get a seconder. The Auditor said it appeared to him that the Council had been acting not only directly in opposition to the Public Health Act, but also to their own Act, in which specific instructions were laid down as to what to do with any surplus obtained from the gas-works. He could not understand why the Council had gone in the face of the instructions. It was quite clear that the surpluses from the gas-works had not been properly applied. He asked whether the Manager could say why the gas revenue account should be charged with public lighting. Mr. Marsland said he had never approved of the principle. The Auditor said he must have some reason why the Council should go in the face of the Act of Parliament. The Clerk said the practice had been going on for years, and had never been challenged before. The Auditor said that, so far as he could see, the general district rate had been relieved at the expense of the gas-works. It appeared to him that he had no alternative but to deal with the matter. The figures were now to be considered. From their ledgers, it appeared that the expense of public lighting for the year ending the 31st of March last was £866 11s. 5d. He saw no justification whatever for this being charged anywhere but to the district fund account. It meant this—their rates must provide for an expenditure of £866 11s. 5d. He further pointed out that certain expenses had been incurred with respect to the Electric Lighting Order, and he objected to the gas-works accounts bearing the cost. The better course would be to have a suspense account. Why, he asked, should the gas-works be saddled with such an expense? Mr. Clay replied because it was the only profitable undertaking they had. The Auditor remarked that if they wanted anything they had the rates to fall back upon. The Clerk said it was proposed to have a loan for electric lighting, and they could take the expense out of such loan. A suggestion was made that the Auditor might waive his demand for the changed conditions as to the cost of public lighting coming out of the general district rate this year; but he said that, though he was always willing to fall in with the wishes of the Council as far as possible, he did not think he was justified in doing so in this case. Ratepayers would have to pay an increased rate of 4d. or 5d. in the pound; but the gas consumers would have the profit. The Accountant said the charge would operate with difficulty this year, because, owing to the increased price of coal, the surplus would be comparatively small. The Auditor: That is caused by making this improper charge. Mr. Lodge said certainly. He then proceeded to go into the subject of the disposal of coke at the gas-works; but, in the end, the Auditor would not make any disallowance in respect of the amount complained of.

WALKER ELECTRIC LIGHTING SCHEME.

In the "Electric Lighting Notes" in last Tuesday's "JOURNAL," reference was made to the report recently issued by Mr. Sturgess, the Clerk to the Walker Urban District Council, on the progress of their scheme for the supply of electric energy. It has evoked a reply from a correspondent of the "Newcastle Daily Chronicle," who deals with the subject as an example of what he calls "the mischiefs and muddles of municipalization." He says the report provides ample justification of the position taken up by the manufacturers of the district when the proposal to apply for parliamentary powers was first put forward; and he then offers the following observations on the question.

The manufacturers, who pay some 50 per cent. of the rates in the district, and provide employment for the whole population, made a formal protest against the scheme; pointing out that, in their opinion, it was entirely outside the scope of the municipal authority to supply electric energy, which might be at least as efficiently done by private enterprise without involving the ratepayers in any liability should the undertaking not prove successful. At the same time, the manufacturers warned the municipal authority that they would in no way support the scheme. Despite this formal protest, however, parliamentary powers were obtained, a loan was granted by the Local Government Board, and it appears to be only now that the municipal authority realize that the scheme is not likely to be so successful as they predicted, in spite of the protest made against it by the manufacturers, without whose support, as it is justly stated in the report, "it is impossible to see how any scheme in the district could be made to pay."

It is suggested in the report that the manufacturers have an interest in the Walker and Wallsend Union Gas Company—a Company who have taken up the business of producing and distributing electric energy over a very much larger district than that over which the municipal authority obtained powers; and it is implied that such a combination of interests ought not to exist. This is taking a somewhat wider view of the powers of municipal authorities over their ratepayers' business than is—at present, at all events—generally accepted. Assuming, however, for the sake of argument, that such a combination of interests does exist, it is merely a condition of trade, which, in so far as it exercises a considerable effect upon the amount of current likely to be required from the municipal authorities, ought to have been carefully considered before any scheme was entered upon.

The whole tenor of this report goes to show that the cost of current produced by municipal authorities must be greater, not only than that produced by private enterprise, but also than that produced by the manufacturers themselves in their own works; and although it is confidently stated that "it is beyond question that the Council could supply current at the same price as the Gas Company," a careful perusal of the report shows that the statement is absurd, for it appears that "companies working without parliamentary powers in any district get rid of every onus of this nature"—*i.e.*, certain "very definite and binding obligations which considerably increase the cost of such undertakings." Now as "the definite and binding obligations are synonymous with parliamentary powers," it follows that, even if all competition were eliminated, the municipal authority's generating station would be hampered at the outset by the extra cost involved by these "binding obligations;" and the cost of the power must therefore be higher than would be the case were it produced by a private company.

The desire of the municipal authority appears to be that the large consumers should be coerced into taking electric power from what is admittedly a more than necessarily expensive source—of course, to the detriment of their trade—with a view to benefiting the district to the extent of the profits which might or might not accrue from the sale of this electric power. An addition to the rates would seem to be a simpler method of providing increased revenue, if indeed it is necessary. It has apparently become clear to the writer of the report that competitive trading is not intended to be carried out by municipal authorities; and it seems unfortunate for the ratepayers of Walker that this broad fact so plainly stated by the manufacturers was not more fully appreciated before the electric power scheme was embarked upon. The writer of the report frankly admits that the competition which he has apparently only now discovered, in spite of the protest raised by

the manufacturers, would be ruinous if the facilities of which the competitors have availed themselves are legal. Whether they are so or not does not affect the case, for every manufacturer can to-day put down a power-distributing plant, and, unhampered by the obligations required by parliamentary powers, can produce his own energy at a cheaper rate than that at which it can be supplied under the Urban District Council scheme. Successful competition with foreign manufacturers can only be carried on by reducing the cost of production to a minimum; and the report shows clearly that the immediate outcome of this instance of municipal trading is a direct loss to the district, unless, by means of legislative protection, that loss is made good by the manufacturers, at the expense of increasing their cost of production, and thus reducing their chance of successful competition. As reduced cost of production means increased demand, and therefore more prosperity to the wage-earning community, it is difficult to see how municipal trading as described in this report can be considered anything but absolutely inimical to British trade and to the welfare of the district.

ELECTRIC LIGHTING NOTES.

At a recent meeting of the Radcliffe District Council, it was reported that the Local Government Board had sanctioned the Council's proposals to spend £21,500 on an electric lighting and traction scheme for the district.

The Committee of the Norwich Town Council appointed to negotiate with the local Electric Company for the purchase of the undertaking have decided to recommend the payment of £214,000. This would give the shareholders £19 for each £10 share; the Directors would receive £5000 as compensation; and £2000 would be provided for back-dividends.

That the Plymouth municipal electric light undertaking is not realizing the high hopes of its friends has been made very clear of late. Instead of yielding a profit, it has so far been attended with nothing but loss. But it has not until now been thought necessary to keep from the ratepayers information as to the real condition of the undertaking. At a meeting of the Town Council yesterday week, the Electricity Committee announced that the Borough Treasurer had submitted a report on the working of the undertaking for the half year ended the 30th of September last, but that they considered it undesirable to publish it. Alderman Radford, the Chairman of the Committee, justified this course of action, on the ground that it would be quite unfair to judge the undertaking by its receipts in the six lightest months of the year. He added that the Committee had no misgivings, for the figures fairly bore out the estimates. This is not to say very much; for, according to the estimate, the loss on the current year's working will be £1800, and the total deficit at the end of March next will amount to £5000. As no provision has yet been made for either a reserve or a depreciation fund, the fact that the figures only fairly bear out the estimate is not one to cause much jubilation among the sorely-tried ratepayers.

Though most people admit that difference of opinion should not be allowed to alter friendship, they find that in the every-day business of life it generally has this effect. Opinions differ at Sleaford as to whether the lighting of the town has been improved or otherwise by the introduction of electricity. A resident had the temerity to emphatically declare, a few days ago, that the place is not lighted so well now as it was before. His opinion was thus tersely expressed: "The glow lamps are a failure for light-giving power, and the arc lamps are very, very uncertain." The reiteration of the adverb spoke volumes. This statement gave offence to the Chairman of the Electric Lighting Committee (Mr. Bates), who, at the last meeting of the District Council, characterized it as "an absolute lie." This was a singularly bold assertion, in view of the fact that he had just moved the adoption of a report in which it was stated that certain alterations had been made in the distributing plant by the laying of additional cables, and the hope was expressed that "there would be no further trouble with the arc lamps." Moreover, he specially directed the Council's attention to the circumstance that the "defective lamps were receiving all attention." He went on to assure them that before the contractors' representative left the town the lamps would be in "splendid order." With regard to the glow lamps, a great improvement had, he said, taken place. He was sorry there had been any defective lamps, because their opponents had made the worst of it they could. But there was no doubt that the lamps would come all right. There was at present "just a little failure with a few of the lamps, which was being attended to." The Chairman of the Council thereupon remarked: "Then they are not perfect at present; you must admit they are not perfect." Mr. Bates said the town was lit quite as well as it was before the introduction of electricity. The Chairman retorted: "That is a matter of opinion. People who do not think exactly as you do are not telling lies. That is rather strong language to use." The report was then adopted.

In the last issue of the "JOURNAL" we noticed the proceedings at the special meeting of the Cromer District Council at which the electric lighting project was under consideration. It will probably be remembered that Edmundson's Electricity Corporation, Limited, have undertaken, if the Council will apply for the necessary money under their Provisional Order, to erect works, lay the cables, and pay the interest and sinking fund on the loan for fourteen years, at the end of which period the Council may, if they think fit, take them over, or the Company will run them for a further seven or fourteen years, paying all outgoings, doing all repairs as long as they have possession of the works, and carrying on the concern to the satisfaction of the Council's Engineer. The offer was so plausible that it was accepted practically unanimously, for only one member remained neutral. The Council evidently did not appreciate that they were running any risk, but thought they were putting it all on Edmundson's, who, by the way, do not seem to have been disposed to take over the Council's Order, and sink money in the concern. It may be presumed that the amount proposed to be borrowed will all be spent in the first fourteen years. It may therefore be asked, Who will then provide the capital for carrying on the concern, if the Council decline to take it over? Another point which does not seem to have occurred to the worthy councillors has reference to the renewal of the plant. Will this be included in the "repair and maintenance" which the Company undertake? If not, there will be a complete set of very much repaired plant for the Council to take over and finish paying for. The Company guarantee to pay the interest and sinking fund of the loan. But will their revenue allow of this? Supposing they sell 96,000 units per annum at 6d., their receipts will amount to £2400; and if each unit costs 4½d. to produce, the expenditure will be £1800—leaving a profit of £600 per annum, or just 3 per cent. interest upon the amount of the loan, to say nothing of the sinking fund, which will be no inconsiderable amount even if forty years are allowed for repayment. Of course, the Company will find it pay them to sell current at specially low rates in order to create a demand, so as to utilize the entire productive power of their plant; and having obtained a good profit on the initial installation, they could be satisfied with a low return on their sales. But the Council would be in a different position at the end of (say) fourteen years. If they took possession of the concern, more money would be required to renew the plant; and, as a consequence, they would not be able to supply current at the same price as the Company. These are phases of the question which merit attention before the compact is finally ratified, or the Counci may find too late that it was not so free from risk as they all along have supposed.

NIDD WATER FOR BRADFORD.

Under the Bradford Water Act of 1890, the Knaresborough Magistrates recently granted a certificate to the effect that the Gouthwaite compensation reservoir near Pateley Bridge had been completed in accordance with the Act. The procedure is somewhat unusual, and so it will be interesting to give a brief indication of the statements in Court. The Town Clerk, who appeared for the Bradford Corporation, said, under their Act of 1890, they asked the Bench for a certificate of completion with regard to a certain compensation reservoir at Gouthwaite, which reservoir had been finished under the Act referred to, according to its provisions. Under section 9 of the Act, the Corporation were allowed to impound the waters of the River Nidd subject to the compensation reservoir being constructed; and under another section of the Act the Bench had jurisdiction to grant the certificate. The reservoir was to hold 1510 million gallons; but the Corporation were prohibited from taking water higher up the Nidd until a certificate was granted by three Justices of the Peace for the West Riding to the effect that the compensation reservoir was duly completed. Ten days' notice of the application, as required by the Act of Parliament, had been given to the riparian owners and others concerned; and a meeting of these gentlemen had been held at Harrogate, as the result of which it was understood there would be no opposition. Mr. James Watson, the Water Engineer, produced the plans and sections, and proved the proper storage capacity of the Gouthwaite reservoir as required by the Act of Parliament. He stated that the reservoir was designed and constructed by him. Under the Act of 1890, sanction was given to the work. An agreement was entered into between the millowners and the Corporation that the reservoir should have a capacity of 1510 million gallons. The statutory requirements of the Act had been more than complied with. The top surface water had been raised to 446 feet above the mean sea-level; and there was a storage capacity of about 1600 million gallons. The Bench were satisfied; and the certificate was accordingly granted.

The position now is this: The Bradford Corporation have received formal and legal authority to utilize the Nidd water supply, and the authority dates from the receipt of the certificate which was granted on Wednesday. Bradford will now be in possession of a substantial addition to its old water supply; and henceforth, under ordinary circumstances, there will be coming daily from the head waters of the Nidd between 5 and 6 million gallons of water, and in wet weather a considerably larger quantity. The conduit from the new service reservoir at Chellow Heights to Woodale, near Little Whernside (which is 30 miles in length, including 7 miles of tunnelling) is in working order. When the new reservoir, which is to be built at Augram, still nearer the source of the Nidd (and for the construction of which the Corporation have already decided to invite tenders), is completed, a much larger quantity of water will be available even in dry weather; but it may be noted here that above Burn Gill the Corporation have not power to take more than 17 million gallons a day. Here there will be an automatic gauge; and any quantity of water over the prescribed limit will be diverted into the Gouthwaite compensation reservoir. But the present single line of conduit and piping will only carry about 11 million gallons per day; so that the automatic gauge will not be required until the line of conduit is doubled. Burn Gill is only 9 miles down; and below this the conduit receives water from a number of streams and important internal sources. Indeed, half of the 5 or 6 million gallons which will now flow along the new conduit will be received into it at points below Burn Gill.

Incandescent Gas Lighting in Hull Streets.—According to the "Hull News," the Corporation are desirous of having the incandescent system of gas lighting, which is now in use in the main streets in the centre of the city, extended to the whole of the public thoroughfares; and the Works Committee have resolved to instruct the British Gaslight Company to substitute incandescent burners for those at present fitted in all the single-light lamps. It appears that the change will not entail any additional cost, as the Gas Company will do the lighting on the old terms. When the new system has been brought into operation, all the central and western parts of Hull will have the advantage of the improved lighting. The eastern portion is in the hands of the Sutton, Southcoates, and Drypool Gas Company, with whom, it is stated, negotiations are pending with the view to incandescent lighting being adopted in their area. Should this be done, Hull will probably be the only city of its size in the United Kingdom lighted entirely by means of incandescent burners.

RATING OF THE GRAND JUNCTION WATER-WORKS.

The Company's Valuation Appeal.

Monday, Nov. 4.

To-day the inquiry was resumed (*ante*, p. 1049) by Mr. ERNEST PAGE, K.C., into the value of those portions of the undertaking of the Grand Junction Water Company which are situate within the parishes of St. James's, Westminster, Marylebone, Paddington, St. Margaret and St. John, Westminster, and St. George's, Hanover Square. The Company had appealed to the Clerkenwell Sessions against the assessments of these parishes; and the matter was referred to Mr. Page to make a valuation.

Mr. BALFOUR BROWNE, K.C., Mr. BOYLE, K.C., and Mr. SNAGGE represented the Company; Mr. F. MARSHALL, K.C., and Mr. DIGHTON POLLOCK appeared for St. James's, Westminster; Mr. ENGLISH HARRISON, K.C., and Mr. RUSSEL GRIFFITHS for Marylebone; Mr. DANCKWERTS, K.C., and Mr. CUNNINGHAM GLEN for Paddington; Mr. DANCKWERTS and Mr. W. C. RYDE for St. George's, Hanover Square; and Mr. W. C. RYDE for St. Margaret and St. John, Westminster.

Mr. BALFOUR BROWNE, at the outset, said he was glad to announce that the parties had been able to effect an arrangement as to the intercommunication 24-inch main in Oxford Street, which had been considered in the parish of Marylebone, but which, it was found, was in the parishes of Paddington, St. George's, Hanover Square, and St. James's, Westminster. It had been agreed that the portion from Lancaster Gate to the fourth house in Connaught Place should be in the parish of Paddington; from that point to Swallow Passage, in the parish of St George's; and the remainder, in the parish of St. James's. This arrangement would entail a re-adjustment of the figures of their valuation, and would put Paddington into about its old position.

Mr. PAGE said the question was purely one of fact; and it would have been almost impossible for him to have come to a decision on the subject.

Mr. ENGLISH HARRISON remarked that it was a serious question for Marylebone.

Mr. BOYLE said they were appealing against the assessment, and Marylebone had assessed them for pipes which were not in their parish. The persons to complain were the Company; and the whole difficulty had arisen from the mistake of the parish.

Mr. *W. Marshall* was recalled to give the amended valuations. Those in the parishes of Marylebone and St. Margaret and St. John, Westminster, were not altered. The other three parishes were as follows:—

Parish of Paddington.

Annual water receipts, £46,516 at 9·35 per cent. . .	£4349
Less rates at 5s. 8d. in the pound	960
Net rateable value of service-mains	£3389
Net rateable value of indirectly productive mains, at 5 per cent. on structural value of £57,924 . . .	2896
Total net rateable value	£6285
Add proportion of total maintenance of mains . . .	2239
Total gross value.	£8524

Parish of St. George's, Hanover Square.

Annual water receipts, £42,950 at 9·35 per cent. . .	£4016
Less rates at 5s. 8d. in the pound	887
Net rateable value of service-mains	£3129
Net rateable value of indirectly productive mains, at 5 per cent. on structural value of £31,332 . . .	1567
Total net rateable value	£4696
Add proportion of total maintenance of mains . . .	1269
Total gross value.	£5965

Parish of St. James's, Westminster.

Annual water receipts, £27,199 at 9·35 per cent. . .	£2543
Less rates at 5s. 4d. in the pound	535
Net rateable value of service-mains	£2008
Net rateable value of indirectly productive mains, at 5 per cent. on structural value of £11,420 . . .	571
Total net rateable value	£2579
Add proportion of total maintenance of mains . . .	728
Total gross value	£3307

Mr. *J. Wilson*, Revenue Clerk to the Company, proved the correctness of the water-rentals in the various parishes.

Mr. *Walter Hunter* was recalled, and examined by Mr. BOYLE. He said the length of the main in Paddington was 2790 yards, and the value £9110; in St. George's, Hanover Square, it was 1507 yards, and the value £5812; and in St. James's, Westminster, it was 366 yards, and the value £1411.

Mr. BALFOUR BROWNE explained, with reference to the cost of land (which was now valued at £103,477), that the £26,000 mentioned was not the total expenditure. In the item of £987,000 for machinery and plant, there was included the cost of a certain amount of land.

Mr. *H. E. Jones* was also recalled and cross-examined by Mr. RYDE as to the item for tenant's capital.

Mr. BALFOUR BROWNE said this concluded the Company's case.

Mr. DANCKWERTS said the Company had promised to call their Secretary; and he wished to ask for the production of the book which contained a valuation or the cost price of all the mains and pipes.

Mr. BOYLE said the book should be produced.

Mr. MARSHALL then opened the case for St. James's, Westminster. He said their position was this: The former valuation was £4600; and at the last assessment they had raised it to £5421. The Company on their appeal asserted that the net value in St. James's was £3752; and this amount they had now reduced to £2579. The increase made by their surveyors in the new assessment was only £2821, or at the rate of about 6 per cent. on the old valuation; and he (the learned Counsel) found that the total water-rentals and the net profit of the Company had advanced in the same proportion during the quinquennial period—viz., from £187,782 in 1895 to £217,613 in 1900, and from £100,015 in 1895 to £116,970 in 1900. These facts showed that *primâ facie* the increase of the Overseers was a fair and reasonable one. The learned Counsel, in some detail, criticized the figures put forward by the Company's witnesses; contending that the item of nearly £20,000 for lowering the mains should have been charged to capital, and that the amount for tenant's capital had been largely over-estimated. He then alluded to the charge for maintenance and repairs; urging that the average on this account in fifteen years was only £12,000 a year, as contrasted with the £31,000 suggested by the Company's Surveyors. The amount of 1 per cent. for maintenance was too high, for in sixty years—the average life of a main—they would have a capital sum of £2,250,000 to replace plant only costing £1,250,000.

Mr. PAGE said he agreed that the Company could not charge for repairs anything beyond what was necessary to replace the heriditament. For instance, if they replaced a 6-inch main by a 9-inch, the difference in value should certainly be charged to capital. There was, however, a good deal to be said on both sides.

Mr. MARSHALL (continuing) dealt with the valuation of the land and machinery; pointing out that the land, which was valued for rating purposes in 1895 at £54,000, was now valued at £103,400, and that the machinery, valued in 1895 at £590,000 (and on which, according to the Company's accounts, a sum of £110,500 had been expended during the last five years), was now valued at the great advance of £789,000. The Company wished to make out that machinery wearing out and becoming obsolete was actually yearly growing in value. In conclusion, the learned Counsel contended that the charges made by the Company since the last valuation were of an extravagant and unreasonable character.

Mr. *Volkard*, Accountant of the Company, produced the ledger containing the details of the cost of the mains. This book did not have the entries prior to 1871; and witness agreed to furnish next day the particulars of the valuation given by Mr. Vigers—£383,643—on behalf of the Company at the last appeal, which, it was said, was prepared by Mr. Fraser, at that time Engineer of the Company.

Tuesday, Nov 5.

Mr. *William Eve*, examined by Mr. DANCKWERTS, said he found the net receipts of the Company to be £149,762; and this was the amount that had to be divided between the landlord and tenant. He considered that a provision by the tenant of £35,000 cash to start with was ample. Then for tools, furniture, plans, &c., he had allowed £5300, for meters £6500, and for tenant's stores £3500; and taking 17½ per cent. of the total of £50,300, he arrived at £8802. This sum, deducted from the net receipts, gave the landlord's share of the undertaking. Witness did not agree that the amount of £12,000 for lowering the pipes frozen during the winter of 1895 should be allowed, as he was of opinion that this constituted an improvement to the hereditament, and so should be paid out of capital. His average for maintenance and renewal was 1·73d. per million gallons; and this, taken on the supply during the account year, equalled £12,824, as against £16,003 actually spent and allowed by him under the head of expenses. To this £16,003 he had added a sum of £4000, which included allowances for ultimate renewal, &c.; and this gave a total of £20,003—56 per cent. above the average spent per million gallons supplied during the last fifteen years Witness estimated the rateable value of the strictly productive portion of the undertaking, *plus* rates, at £73,262—that was, 33·66 per cent. on £217,613, the total water-rentals.

Mr. DANCKWERTS: Therefore what you have to do in the parish is to get 33·66 per cent. on the gross receipts, deduct the rates from that, and it will give you the rental?

Witness: There is another element to be considered, more especially in St. George's, Hanover Square, having regard to the great value of the property supplied, and the fact that such a number of the inhabitants go out of town at the very time when there is the greatest difficulty in supplying water. I consider St. George's should have a larger percentage than the average of the whole; and therefore the percentage will have to be less somewhere else.

In cross-examination, witness contended, with regard to the apportionment between the landlord and tenant, that everything which maintained the hereditament in a condition to command the rental should be paid by the landlord. He had added the £4000 to expenses, in order to cover possibilities. This sum was taken as being 25 per cent. on the total actually spent. In reference to the value of the land, witness said he valued that at Campden Hill at £5500 per acre, Hampton £500 (except the part only used as a catch ground, which, in his judgment, was to a very large extent a failure, and that had been put at £250 an acre for the purpose it served), Hanger Lane (Ealing) £600, and Kew Bridge £700. These sums were absolutely irrespective of the price of the land in the vicinity; they were taken as the value of the ground for the purposes now served.

Mr. *Samuel Wood*, of the firm of Messrs. Lass, Wood, and Co., examined by Mr. W. C. RYDE, stated that he had gone through the Company's books and prepared statements upon which the surveyors called as witnesses for the parishes had based their valuations. He handed in a statement showing that, if the hypothetical tenant enjoyed the same credit as the Company, he would have to provide funds to meet the maximum deficiency of £65,828; and he would require in addition £10,000, making the total working capital needed £75,828.

Mr. *W. H. B. Castle*, in reply to Mr. MARSHALL, said he had prepared a valuation of the property of the Company in the parishes now in question. He had taken for water-rentals the same figure as was adopted by Mr. Eve, and included the water supplied to the East London

Company. He estimated the tenant's expenditure at £64,195; and this amount, deducted from the gross receipts, left the net receipts, *plus* rates, at £158,710. In regard to tenant's allowances, he had taken the £64,195, to which he added £1000 for repairs to tenant's stock, giving £65,195. Witness took the rates at 5s. 6d. all round, or £17,928, making a total for the year of £83,123. Then, for the purposes of calculation, he had taken four months of that—£27,707. His general rule was to allow seven months; but when he saw the amount of money that was coming in, he thought four months would be ample.

Mr. MARSHALL: In the case of gas companies, what is the usual allowance?

Witness: It all depends—four months, as a rule.

Water companies are able to get their payments in advance, I believe?—You see how they do get them by the accounts themselves.

But everybody admits that they have legally the power?—Yes.

Gas companies have no such power, have they?—No, they have not.

Witness (continuing) said that, in addition to the four months, he had allowed a floating capital of £10,000, making together £37,707. He had taken stores and meters at Mr. Marshall's figures; and the total came to £54,397. On this, he had taken 17½ per cent.—£9625—which, deducted from the £158,710, the net receipts, *plus* rates, left £149,085 for the landlord and rates. The landlord's allowances or statutables had to be deducted; and the remainder—£137,589—was the rateable value of the whole undertaking, *plus* rates. Of this amount, £65,085 represented the unproductive portion; and this gave him the rateable value of the service-mains, &c., at £72,504, or a percentage on the whole of (say) 33 per cent.

In cross-examination, witness said that, in an ordinary case, he allowed seven-and-a-half months in hand for expenses; but in the present instance he considered four months quite sufficient. Had he taken the former figure, the total would have been £78,000, as against £81,000 allowed by Mr. W. Marshall for the other side.

Wednesday, Nov. 6.

Mr. *Castle*, further examined by Mr. BOYLE, said he had put nothing down for the average expenditure for the quinquennial assessment appeals. He did not consider it necessary for any incoming tenant for the year afterwards to take into account what somebody else had spent to protect himself in any particular year.

Mr. BOYLE: Somebody has to pay it?

Witness: It must come out of the general concern.

That is what I say; it must be deducted out of the general concern. You have not deducted it?—No.

Continuing, witness said, as regarded the land, he had not adopted figures which answered the purpose of his valuation, and altered those which did not.

Mr. BOYLE: Is not the land worth £10,000 an acre in that district?

Witness: Not for the Water Company's purposes.

For the purposes of the Water Company, because of its being high land, is it not more valuable than for other uses. Would not the land sell for building at £10,000 an acre?—I daresay it would.

Am I right in saying that in Hampton, in Ealing, in Kew, and in the whole of the district, during the last twenty years, all building land has doubled in value?—All building land may have.

Mr. *W. G. Cooke* gave evidence on behalf of the parishes of Paddington, St. James's, Westminster, and Marylebone. Witness said he had taken the gross receipts at £222,904, and the net expenditure at £57,800. This left the net receipts, *plus* rates and taxes, at £165,104. Tenant's capital he calculated at 17 per cent. on £55,000—£9625—and this amount, deducted from the net receipts, gave £155,479 as the gross value of the entire undertaking, *plus* rates and taxes. He deducted from this sum £19,070 for maintenance and repair and further renewals, giving £136,409 as the rateable value of the undertaking, *plus* rates, of which £59,696 was the rateable value of the supply mains, *plus* rates. Witness had prepared a valuation of the undertaking in the three parishes with which he was concerned. These were as follows:—

Parish of Marylebone.

Water-rental for the year ending March 31, 1900, £7498.

Rateable value of service-mains, *plus* rates, calculated at 35¼ per cent. of £7498	£2643
Less rates at 6s. 0½d. in the pound, on a rateable value of £2030	613
Rateable value of service-mains	£2030
Add carrying and pumping mains, 5 per cent. of £1160.	58
Total rateable value of the water mains and pipes in the parish	£2088
Add for maintenance and renewal 10 per cent.	208
Total gross rental value of the water mains and pipes in the parish	£2296

Assessment appealed against.

Gross	£1965
Rateable	£1720

Parish of St. James's, Westminster.

Water-rental for the year ending March 31, 1900, £27,199.

Rateable value of service-mains, *plus* rates, calculated at 35¼ per cent. of £27,199.	£9587
Less rates at 5s. 4d. in the pound on a rateable value of £7569	2018
Rateable value of service-mains	£7569
Add carrying and pumping mains, 5 per cent. of £5160.	258
Total rateable value of the water mains and pipes in the parish	£7827
Add for maintenance and renewal 10 per cent.	782
Total gross rental value of the water mains and pipes in the parish	£8609

Assessment appealed against.

Gross	£5977
Rateable	£5921

Parish of Paddington.

Water-rental for the year ending March 31, 1900, £46,516.

Rateable value of service-mains, *plus* rates, calculated at 35¼ per cent. of £46,516.	£16,396
Less rates at 5s. 8d. in the pound, on a rateable value of £12,776.	3,620
Rateable value of service-mains	£12,776
Add carrying and pumping mains, 5 per cent. of £47,868, as per Company, for last quinquennial	2,393
Total rateable value of the water mains and pipes in the parish	£15,169
Add for maintenance and renewal 10 per cent.	1,516
Total gross rental value of the water mains and pipes in the parish	£16,685

Assessment appealed against.

Gross	£14,800
Rateable	£13,454

In arriving at these valuations, witness had taken a percentage on the gross receipts of 35·25. For his general statement, he had valued the Kew Bridge works at what he considered the value as a site for waterworks. Hampton was taken on the same principle; and the intake works at a lesser figure than the Company had arrived at, because they did not make use of the works to the full extent that they were erected for. Regarding the rateable value of the indirectly productive works, he might say that he had included the inter-communication mains. These had been treated by the Company as supply mains; but a pipe or a main could not at the same time be both direct and indirect. He considered the lowering of the mains to be distinctly a capital charge, as it was an improvement of the hereditament.

In cross-examination by Mr. BOYLE, witness said he had adopted the rough-and-ready method, in calculating the tenant's capital, of taking so many months. He had made no valuation of the buildings, machinery, or plant, but adopted Mr. Quick's figures. In fixing the valuations, he had taken a percentage on the gross receipts of 35·25.

Mr. *F. C. Ryde*, of the firm of Messrs. Ryde and Sons, in reply to Mr. MARSHALL, said he had taken the gross receipts at £222,905. Tenant's expenses he calculated at four months, which gave him nearly £30,000. He added the stores, and put on a balance of £5000 to the four months money, thus arriving at a total of £55,000, of which he took 17½ per cent.—£9625. The rateable value of the entire undertaking, *plus* rates and taxes, he estimated at £135,937; and deducting the rateable value of the indirectly productive portions—4 per cent. on the value of land and 5 per cent. on buildings, in all £63,601—left the rateable value of the supply-mains, *plus* rates and taxes, as £72,336, which was 33·24 per cent. of the gross receipts.

Mr. *Joseph Quick*, M.Inst.C.E., submitted a valuation of the structural portion of the undertaking, stating that it was based upon the same horse power as Mr. Hunter's; but witness had made a reduction of 7 per cent. for slip. This left a value of the effective pump-horse-power of £13,581; and having obtained this, he had taken out his prices on the basis of £45 per effective pump-horse-power, inclusive of engines and boiler-house, coal-stores, and chimneys. This was a price at which they could be replaced by modern steam-engines.

Mr. MARSHALL: How do the modern engines compare with the older ones that we have heard so much about in this case?

Witness: They cost less to start with; the space occupied by the buildings in which they are put is considerably reduced; they work more economically; and the outlay is less for repairs. They also possess other advantages over most types of old engines—more particularly the old Cornish engines—not the least of which is the fact that, with the Cornish engine, they had to lift a weight equivalent to the maximum head of water; every stroke of the engine varying according to the demand of the district. Modern engines absorb less power in the working of the engine itself; they have fewer working parts; standpipes and towers are not required; and the friction in the working is less.

In further examination, witness said his valuation was as follows: Engines, boilers, and buildings, £161,145; mains and valves on works, £7901; reservoirs, open, £83,000, covered, £76,625; filters (sluice-chamber included), £205,702; Ealing works, exclusive of reservoirs, £3088; minor buildings, fencing, workshops, and offices, £16,331; drains (Campden Hill), £444; carrying and pumping mains (including the cost of laying), £401,528; river walling, Hampton, £2700; new Hampton intake works, £2360; natural filtration works, £2303—or a total for the unproductive works of £963,025. To this he added the land, as per surveyors, £75,000, making altogether £1,038,025.

Thursday, Nov. 7.

Mr. *Quick* was to-day further cross-examined by Mr. BALFOUR BROWNE. He handed in a detailed summary of his valuation of the works of the Company, as follows:—

—	Engines and Boilers, Houses and Main Buildings.	Reservoirs. Open.	Reservoirs. Covered.	Filters.
Kew Bridge	£56,925	16,875	8,750	73,465
Hampton	82,035	28,125	9,375	132,237
Campden Hill	22,185	—	58,500	—
Ealing	1,345	38,000	—	1,743
	£162,490	83,000	76,625	207,445

	Mains and Valves on Works.	Minor Buildings Do.	Intakes from River.	Total.
Kew Bridge	6,393	6,185	—	168,593
Hampton	21,945	4,352	7263	285,332
Campden Hill	2,493	4,231	—	87,409
Ealing	1,570	1,917	—	44,575
	32,401	16,685	7263	585,909

For the pumping and carrying mains, he allowed £401,526. The valuation of the mains and pipes was only concluded a few days ago, because he had to get some information as to the price of iron. Witness was cross-examined in some detail as to the prices at which he had valued the engines. From one point of view, old and new engines were equally valuable; but the new engines had many advantages, and were more economical.

Mr. *W. A. Valon*, J.P., examined by Mr. CUNNINGHAM GLEN, said he had for the second time made a valuation of the works of the Grand Junction Company; having previously done so for the appeal in 1896. He estimated the total value of the structural portion of the undertaking at £548,598, allocated as follows: Hampton, £264,218; Kew Bridge, £156,722; Campden Hill, £87,508; and Ealing, £40,150. Witness valued the indirectly productive mains of the whole concern at £381,909, to which had to be added an allowance for cocks and specials, making a total of £396,372. In valuing the engines, he had calculated at £30 per pump-horse-power, which was the standard value upon pumping-engines at the present day. In his opinion, the old machinery was not so useful as modern plant. It was more cumbersome, took up more room, and was less efficient. The tenant would, in his view, pay rent according to the usefulness of the plant. The greatest difference in his valuation was under the heading of filter-beds. He had valued the boilers separately in the first instance, and found the value less than £5 per horse power. They had taken £5, which was the usual allowance; and it came within a few pounds of Mr. Marshall's valuation.

The ARBITRATOR remarked that he did not see how witness's value resulted in a smaller figure.

Witness said the whole difference between them was the value of the seatings and the reservoirs, and the filters. He considered £6000 per acre for filter-beds was sufficient; but he had, in view of the rise of wages, allowed £7500 an acre. In his opinion, he had valued the mains and pipes at fair and reasonable values. The lengths and sizes of these they had taken from Mr. Hunter.

In cross-examination by Mr. BALFOUR BROWNE, witness said he had valued the filter-beds at £7000 per acre. Mr. Quick had priced them at £8000; but he believed £7000 was the figure arrived at by Sir A. R. Binnie before the Royal Commission on London Water Supply.

Mr. BALFOUR BROWNE: Will you tell me that Sir Alexander Binnie did not put filter-beds without ironwork at £10,000 an acre?

Witness: I am afraid I have not got that.

I will give you the question (No. 1773), where Sir Alexander Binnie puts it at a round figure of £10,000 an acre I believe that was without the ironwork; but I am not sure?—I should not think so. I should almost dispute that with him.

Proceeding, witness said the difference in the valuation of the pipes was principally that he put a lower price for the paving. The figure for the engines he had reduced to the standard value of to-day.

In re examination by Mr. MARSHALL, witness said there was an excessive difference between filter-beds, because they were not wanted to last too long. As to the mains, he had not considered the cost of having to cut through asphalte or wood as one of the items in respect of which there should be a fund for renewal or a charge for repairs. When he was valuing the main *in situ*, the fact that it was more difficult to get at did not add anything to the value of it—on the contrary, it lessened the value.

The ARBITRATOR: Does it not seem to you that the method you have applied with regard to mains is somewhat inconsistent with that applied to buildings. When you take buildings, you reduce the rent payable by a tenant, because you say to-day a building would cost less than the one which exists? On the other hand, with regard to mains, you do not increase the rent, although you admit that if the mains were laid to-day they would cost more?

Witness: No; I think that is perfectly consistent. The main to-day is of the same value as when it was laid; but the building would never be put up.

Mr. *Eve*, recalled and examined by Mr. W. C. RYDE, for the parish of St. George's, Hanover Square, said he had taken the water and meter rental in that parish for the year ended March 31, 1900, at £42,950, and the rateable value at £13,253, as against £9100, the assessment appealed against. In regard to the parish of Paddington, witness estimated the rateable value as £15,443, while the sum appealed against was £13,454; and for Marylebone £2042 and £1720 respectively.

Mr. *F. C. Ryde*, recalled and examined by Mr. W. C. RYDE, said he had worked out the rateable value of the parish of St. Margaret and St. John, Westminster. The water-rental was £492; and the rateable value of service-mains, at 33·24 per cent., was £163. Deducting rates at 5s. 6d. in the pound, the net rateable value was £128.

Mr. *Frank Stewart*, partner in Messrs. Greenwell and Co., proved that they had not received the letter from Messrs. Bircham and Co. making any alteration in the assessment of St. Margaret.

Mr. *W. G. Cooke*, for St. James's, Westminster, estimated the rateable value of the Company's property in that parish at £7412, and the gross value at £7968.

Mr. *Walter Hunter* was recalled and examined at some length as to the details of the accounts which he had handed in.

At the conclusion of the day's sitting,

The ARBITRATOR, addressing Counsel, said there were certain questions arising out of the inquiry which were more or less questions of law; and he wished all the Counsel to give him such aid as they could in deciding these points. Firstly, he had to decide what was the effect (if any) on the rateable value of substituting wood for macadam over pipes already laid. Secondly, with regard to the time for the payment of rent, should he consider that the landlord and tenant had left this to the general law, or that they had made some reasonable agreement on the point prior to the creation of the tenancy? Thirdly, in considering the renewal fund, was he at liberty to take into account renewals rendered necessary by increased public demand? Fourthly, how should the damage by frost in 1895, and the consequent lowering of mains, be dealt with? Fifthly, how should the receipts and expenditure in relation to the supply to the East London Company be dealt with? Lastly, what portion of the total expenditure on maintenance and repair should be borne by the landlord and what portion by the tenant?

The inquiry was then adjourned until last Saturday (the 16th inst.).

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

By the death of ex-Bailie Kinloch Anderson, the City of Edinburgh has lost a leading municipal worker, and the Edinburgh and Leith Gas Commissioners a veritable pillar of their household. It was, perhaps, his most prominent personal characteristic that Mr. Anderson could not be a member of any body without taking an active part in its business. His doctrine was that work and honours should go together. When the Gas Committee were brought into being, he set himself at once to learn all that a layman could of the working of a gas undertaking. It was evident, from the rapid improvement in the quality of his public utterances, that he was an apt scholar. Latterly he could discourse upon gas plant with almost the authority of a professional man. When, under the advice of Mr. W. R. Herring, the Engineer to the Committee, it was thought desirable to erect new works, Mr. Anderson did herculean labour in the selection of a site; and when Granton had been finally adopted, in settling the details of the scheme of translation. Towards this end, he was one of the Commissioners who undertook the task of visiting gas-works in England and on the Continent, in order to see the most modern plant. He became a candidate for election as Lord Provost of Edinburgh in 1897, but was unsuccessful, which was greatly to be regretted, because, considering the amount of work he had done for the public, no one better deserved the position.

As was to be expected, time is enabling one to somewhat understand the reasons which have led the Gas Corporation of Arbroath to deal so sharply with Mr. R. S. Carlow, their Manager. Two sources of enlightenment have come to hand. One is the report of the proceedings at a meeting of the Corporation on Thursday evening, which is given in another column; and the other is a letter by Mr. J. D. Royal, of Watford, which is published in the local Press to-day. At the meeting, Mr. Lorimer said: "We have been unable to get at the shortage of coal; and the shortage of coal was really the start of all this." That is to say, the members of the Corporation had their attention drawn to there being something amiss at the gas-works by the fact that about 400 tons of coal could not be accounted for, except by the theory that the men put a few lumps more than the weight upon their barrows when they loaded them; that an investigation was instituted; and that then something else was discovered which was not as it should have been. Whether there be more than one of these, I do not as yet know; but it is to be gathered that there is some question about payments for the services of a gardener, in regard to which Mr. Forbes, one of Mr. Carlow's supporters, said that he (Mr. Carlow) had offered to reimburse the town the money, and a similar statement is made by Mr. Royal in his letter. There is a shadow of something else, in the words of the petition which citizens presented to the Corporation, to the effect that "the complaint in respect of which you propose to dismiss him was generally of carelessness and inattention." These are weighty charges to make against anyone in a position of trust; and the petitioners seem not to dispute that there are grounds for them. A certain light is thrown upon the situation by the fact that the foreman in the gas-works was summarily dismissed; and we are not told what for. Why all the mystery? A somewhat cruel remark was made at the meeting, that Mr. Carlow had a copy of the report of the Committee of Investigation and that they had no objection to his publishing it. Where the cruelty comes in, is that the foreman is also in the report; and if Mr. Carlow were to publish it, he might be held to be slandering the foreman. The attitude of the Corporation in this matter seems to be one of fear at the consequences of their own action. Some may prefer the view that the Corporation are desirous not to hurt Mr. Carlow more than they can help; but I am disposed to dismiss that idea, because of the remark that he might publish the report, which is that if he chooses to do a thing they are afraid to do, they will not object. It is not to be left out of account that Mr. Carlow has not spoken in his own defence; but I find in Mr. Royal's letter so much informed pleading on Mr. Carlow's behalf, that I take it to represent Mr. Carlow's views. Mr. Royal writes from Hertfordshire; but he knows that in Arbroath there is coal storage accommodation for nearly two-thirds of the annual requirements; that through Mr. Carlow's foresight the town was saved from being in darkness during the railway strike; that on a later date the big stock of coal saved the Corporation from paying a heavy price when coal went up; and that for long the gasholders were utterly insufficient to cope with the heavy winter's demand. He knows that Mr. Carlow passed many an anxious night, using every device known, and exerting all his skill, in order to maintain the town's supply of gas; and that he had made the Arbroath works a model—one which he had been assured, by competent critics in both Scotland and England, was well worth visiting. Mr. Royal makes a strong appeal on behalf of Mr. Carlow, and asks if his error is to cancel all he has done for the gas-works. If so, he considers, the gas managership of Arbroath is no post to be coveted. If not, then an injustice, and that of the worst type, has been done; and to right the wrong there is only one way, and it is not yet too late. All this is quite fair pleading; but will Mr. Royal's assertion be generally accepted, that "given the opportunity, this practice is common in almost every gas-works in the kingdom?" That is, the practice of piling coal on to the barrows after they have been weighed. The object, it is said, is to make an apparent increase in the quantity of gas made per ton of coal. Managers will know whether or not they allow such a practice to exist.

I have written nothing upon the merits of the question, because of the report upon which the whole matter turns not having been forthcoming. That Mr. Carlow has a great many friends in Arbroath, is manifest from the very large number of prominent citizens who signed the petition to the Corporation to give him a period of probation. The Corporation would not listen to the petition. For them, the report of the Committee of Investigation was sufficient. In their estimation, painful though the duty was, there must be a severance of a tie which has lasted for about twenty years. The severance is to take place; and a Committee have been appointed to look out for a successor to Mr. Carlow. It is a painful subject to write upon. The feeling in my mind is that it would have been better for Mr. Carlow, seeing he does

not attempt himself to combat the Committee's report, if his friends had not provoked the discussion of Thursday evening.

A special general meeting of the Old Meldrum Gas Company was held on Monday, at which it was agreed to sell the undertaking of the Company to the Town Council of Old Meldrum, at the price of £300, and thereafter to wind up the Company.

On Wednesday, as darkness was setting in in Dundee, the armature of a small electric motor in the Corporation electric lighting works burned out, with the result that the whole establishment was brought to a standstill. The portions of the city which are lighted by electricity were left in darkness; and the electrically driven street cars stood motionless and unlighted on the streets, a source of danger to themselves and others. After about twenty minutes, the current was again turned on; but it was some time before it worked satisfactorily. While it lasted, the cessation was the cause of great inconvenience to the community.

That there is a haziness as to the proper plan of dealing with funds of the reserve or depreciation sort, was illustrated by what took place in the Edinburgh Town Council last Tuesday week, in connection with the Corporation electric lighting undertaking. The Committee recommended that the charge for electric energy from Sept. 30, 1901, to Sept. 30, 1902, be fixed at the same rate as last year—viz., private lighting, 3¾d. per unit; public lamps, £13 each per annum; motor power, 1½d. per unit. The Committee also submitted a report by the Chief Electrical Engineer on the condition of the plant and mains for the half year. Mr. Mackenzie said that the Council were no doubt aware that during the summer months the revenue on all electric light and gas undertakings fell off, and that a loss was the result. They were better, however, this year than last. Last year they did not commence to make a profit until the week ending Oct. 10; but this year profit was made a week earlier, and up to date they had made £1071 of profit, as compared with £220 at the corresponding date last year. In reply to Treasurer Cranston, Mr. Mackenzie said Professor Kennedy reported that the plant and mains were all in good order. Mr. Welsh said there had been a loss on the year's working; and they ought to know more about it. He held that the concern should be self-supporting. Mr. Carmichael pointed out that they began the year with a debit balance of £2690, which he understood was to be taken out of the reserve fund. Treasurer Cranston said he had overlooked that. The reserve fund was not created for making up deficits. He asked Mr. Mackenzie if the estimated revenue from the prices fixed per unit would enable them to replace this sum to the reserve fund and have a surplus besides at the end of the year. Mr. Mackenzie said it was the opinion of the Engineers and himself that this was so. Mr. Mallinson contended that the electric light should pay its way, and always have a small balance to the good. The reserve fund, as he understood it, was not to be drawn upon to make up a deficit of this kind, but was to act as a guarantee that any accident to the machinery or plant of the electric light undertaking should not be thrown on the rates. He moved that the price for private lighting be raised ¼d. per unit. Mr. Cameron seconded. Mr. Harrison, in seconding the adoption of the Committee's recommendation, urged that it would be unwise to raise the price since coal was now cheaper. Treasurer Cranston favoured the adoption of the recommendation, believing that the figures were perfectly satisfactory. Mr. Neill complained of the insufficiency of time they had had to come to a decision. Mr. Mackenzie, in reply to Mr. Fraser, said the reserve fund amounted to between £18,000 and £19,000; but he did not think they need concern themselves about the point Mr. Carmichael had raised, which was merely one of accounting. On a division, the Committee's recommendation was adopted by 25 votes to 18.

Some things a little more suggestive than usual were said at a meeting of the Edinburgh Water Trust on Thursday of this week. It was reported that the Trust had purchased about 43 acres of land at Fairmile Head, from Sir Henry Trotter, upon which to erect storage tanks and filter-beds in connection with the new Talla water supply. The price paid is £20,000, which is at the rate of about £445 per acre. Sir Andrew M'Donald said he observed that claims had been put in by Contractors for extras to the amount of £43,323. He thought that these could hardly be called extras. Bailie Archibald said that when they obtained parliamentary authority in 1835 to bring in the new water, no one had any thought that they would not have it by this time; but at the rate at which they were proceeding, it might be another five or even ten years before the new supply would be available. If they went on as they were doing, the works might probably cost them £250,000 more than was expected. He moved that it be remitted to a Special Committee to inquire into the cause or causes of the delay. This was agreed to. Then Bailie Archibald, referring to the position of the water supply, said that they had now 150 million gallons more in the reservoirs than they had ten or twelve days ago. They were sending in water at the rate of 14½ million gallons a day; and although they had an increase, it was not likely they would give more water to the citizens, as the reservoirs must be filled first. They had had an anxious time of it; and the tantalizing point was that, while it had been raining heavily all round their area of supply, the rain scarcely ever came into it.

The Dalkeith Town Council augment their water supply by purchasing 100,000 gallons of water per day from the Edinburgh Water Trust. They require more, and had hoped that they would have got it by this time from the Edinburgh Trust. On account of the delay there, the Dalkeith Council have opened negotiations for the purchase of water from a colliery proprietor. The water of this pit has been analyzed by Mr. John Hunter of Edinburgh, who has certified that it may with perfect safety be used dietetically.

London County Council and Water Gas.—At the meeting of the London County Council to-day, the Public Control Committee will ask for authority to continue for a further period of six months the tests of the gas supplied by the London Companies, for the presence of water gas therein, sanctioned on May 21 last year, at a cost not exceeding £4 per week. The tests hitherto made have dealt with summer conditions; but, having regard to the much larger consumption of gas during the winter season, the Committee consider that their series of tests should include that season, so as to be as complete as possible.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 16.

Sulphate of Ammonia.—There has been an active market, and prices have been fully maintained at all points; the closing quotations being £10 17s. 6d. per ton f.o.b. Hull, £10 18s. 9d. to £11 per ton f.o.b. Leith, and £11 1s. 3d. per ton f.o.b. Liverpool. There has been more interest on the part of the Continent, but the heaviest shipments are being made to Spain and the Colonies, and production everywhere has been absorbed by current requirements. December has also been in request at 1s. 3d. per ton over prompt prices. There has been large speculative buying for London delivery, at £11 per ton, Beckton terms, for November-December, and at £11 2s. 6d. per ton for January-March; but at the close sellers are off the market in the former, and £11 5s. per ton is required for the latter position. F.o.b. Leith, ordinary terms, is held for £11 5s. per ton, January-March delivery; but so far buyers stick at £11 2s. 6d. per ton. There has been good inquiry from consumers for delivery up to June, and even beyond; but ideas are for the most part too low to admit of business.

Nitrate of Soda is steady at 9s. 3d. to 9s. 4½d. per cwt. for ordinary and refined qualities, respectively.

LONDON, *Nov.* 16.

Tar Products.—Pitch continues very firm indeed, principally owing to the fact that it is impossible to get supplies for prompt shipment; and as freights are low there is naturally a pressure for early delivery, especially in London. In South Wales, the demand is still very good for November-December, while consumers are open to consider business for January-June, although at present they will not purchase all over 1902. Some 90 per cent. benzol has been sold at 10d. f.o.b. London, prompt shipment; but the same price was declined by refiners here for January-March. 50-90 per cent. is decidedly better, and business has been reported at 9½d. November-December. Crude carbolic continues firm; but consumers will not at present pay any more than 1s. 11d., although makers hold out for 2s. prompt and forward. Crystals are still very dull indeed, and prices do not seem likely to improve. Creosote continues to improve, and the demand for forward delivery in the North is decidedly good. Makers are now asking 1⅛d., and in some instances 1¼d., for forward delivery. Owing to the demand for export, the London market continues good, and prices are firm all round. As regards anthracene, "B" qualities remain in the same hopeless position. There is a better inquiry for "A," but only for delivery next year. It is reported that consumers are willing to pay 2⅛d. for 40-45 per cent. of best "A" qualities; but as a rule makers hold for 2¼d. There is nothing fresh to advise in tar; no contract of importance having come into the market during the week.

The average values obtaining during the week are: Tar, 15s. to 18s. Pitch, east coast, 34s. to 34s. 6d.; London, 35s.; west coast, 33s. to 33s. 6d. Benzol, 90's, 10d.; 50's, 9½d. Toluol, 10d. Crude naphtha, 4½d.; solvent naphtha, 11d.; heavy naphtha, 10d. to 11d. Creosote, London, 1⅜d.; North, 1⅛d. to 1¼d. Heavy oils, 2⅛d. to 2⅜d. Carbolic acid, 60's, 1s. 11d. Naphthalene, 60s. to 80s.; salts, 35s. to 45s. Anthracene, "A," 2d. to 2¼d.; "B," unsaleable.

Sulphate of Ammonia.—The market continues firm; but the demand is quiet, especially for prompt shipment. The Gaslight and Coke Company are reported to have declined £10 18s. 9d. for December, and are firm at £11 5s. for January-June, although at present they are unable to realize this price. Business in Leith is brisk. Sales have been made at £10 18s. 9d., and in some instances £11 has been realized for prompt. For January-March £11 5s. is the current value, and business is reported at this figure. Liverpool is not so good, and prices are rather easier for this year. In Hull, sales are reported at £10 17s. 6d. for best makes November December; but for January-March, makers ask £11 5s.

COAL TRADE REPORTS.

Lancashire Coal Trade.—Excepting a recovery from the disorganization of operations caused by the interruption of mineral traffic over the railways by the recent heavy fog, there is no material change to notice in the condition of the coal trade here. As regards all descriptions of round coal, business moves on steadily. House-fire qualities are in fairly brisk demand, collieries moving away their output without difficulty; and prices are firm at recent full rates. Steam and forge coals continue generally in good request, and steady in price. So far as immediate prospects are concerned, it seems not improbable that current rates for round coal will remain unchanged until after the turn of the year; but in many quarters there are apprehensions that next spring may possibly bring about the necessity for some rectification of prices, and with that a consideration of the wages question. Present quotations average 15s. per ton at the pit for best Wigan Arley, 13s. to 13s. 6d. for Pemberton four-feet and seconds Arley, 11s. to 11s. 6d. for common house coal, and 9s. for steam and forge coal. The shipping trade is fairly active, with quotations for good ordinary steam coal remaining at about 10s. to 10s. 6d. per ton, delivered at the Mersey ports. Lancashire collieries are perhaps selling their slack rather better than of late; but this is due more to the fact that they are to some extent meeting outside competition by easing their prices, than to any increased demand, and notwithstanding these concessions there is still a good deal of slack coming in from other districts at excessively low-cut figures. The better qualities of Lancashire slack average about 6s. 9d. to 7s. 3d. per ton, with the commoner sorts ranging from 5s. 3d. to 5s. 9d. Lancashire coke meets with a steady demand, and remains at about 23s. to 25s. per ton for best foundry sorts, and 14s. to 15s. for good washed Lancashire furnace cokes, at the ovens. Yorkshire coke is rather more plentiful on the market; and prices are scarcely so strong, but are without quotable alteration.

Northern Coal Trade.—The prolonged storm has interfered with the coal trade of the North, delaying both the transit and the shipment of coals. The derangement, however, has been followed by a tolerably full demand, though prices have been made very irregular. Northumbrian steam coals are less in request; and prices are tending towards

the lower level that winter usually brings to this class of coal. Best steams are from 10s. 6d. to 11s. 3d. per ton, on the average; but prices vary with different collieries, according to the extent of the orders booked. Unscreened steams are about 9s. per ton f.o.b.; and steam smalls are steady at 6s. Gas coals are now at about the highest point of demand; and the price is firm, though the supply seems generally adequate. For occasional cargoes, the quotation varies from 12s. to 12s. 6d. per ton f.o.b., according to quality; but the new contracts that are offered are being negotiated at from 2s. to 2s. 6d. per ton below the prices just named. Coke is generally firm. For export, the price quoted is from 18s. to 18s. 6d. per ton f.o.b.; and for blast-furnace coke 16s. 9d. to 17s. 3d. at the Teesside furnaces is the ruling price. Gas coke, though rather more plentiful, is still about 13s. per ton for cargoes, with some variation according to the position of gas-works.

Scotch Coal Trade.—There is still a lack of forward orders. The Railway and Canal Commissioners have notified that the increased rates charged by the Railway Companies since the beginning of 1900 were not justified, but have left it open to the Companies to show that the coalmasters made the public pay the increased charges, which is the fact, notoriously; so that the decision has little effect upon the current market. Prices remain as follows: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 3d. to 11s. 3d., and splint 10s. 9d. to 11s. The shipments for the week amounted to 203,251 tons—a decrease of 11,590 tons upon the previous week, but an increase of 5072 tons upon the corresponding week of last year. For the year to date, the total shipments have been 8,576,913 tons—a decrease of 982,494 tons upon the same period of last year.

Gas and Electric Light at Cowdenbeath.—The ceremony of switching on the electric light for the illumination of the streets of Cowdenbeath took place on the evening of Saturday, the 9th inst. Cables extending to 11,000 yards have been laid from an engine and dynamo house at the Fife Coal Company's No. 7 Cowdenbeath pit, and there are 200 pillar lamps, each carrying two incandescent lights of 16-candle power in the main thoroughfares, and 8-candle power in the side streets. The total cost of the work is about £1800. Simultaneously with the laying of the electric cables, the Cowdenbeath Gas Company have been erecting retorts and laying gas-mains for the supply of gas to shops and dwelling-houses.

Incandescent Gas Light at Kingstown.—At the meeting of the Kingstown Urban District Council last Tuesday, a letter from the Special Committee appointed to consider the advisability of entering into arrangements with the Alliance and Dublin Consumers' Gas Company for the public lighting of the town was read. They stated that the Company were willing to provide, fit up, and maintain incandescent lamps of the latest and most approved pattern, of an average illuminating power of 70 candles, for £2 16s. per lamp per annum. They recommended that the proposals of the Company be accepted. The Committee were directed to draw up an agreement with the Company for submission to the Board.

Gas, Electricity, and Water Supply in Lincoln.—The abstract of the audited accounts of the Lincoln Corporation for the year ending the 31st of March last has just been issued. It shows that the gross profits of the gas undertaking amounted to £8840, of which £1000 was transferred to the general district fund in aid of the rates; and of the water undertaking to £6483, of which £1500 was passed over. On the electricity account, however, the balance in excess of income was £1587.

The Bradford Corporation and the Out-Districts.—At the recent mayoral election for Bradford, Mr. W. C. Lupton was unanimously chosen for the third time to fill the office of Chief Magistrate. In the course of his remarks when returning thanks, he referred to the work of the Gas Department in the past year. He said the Corporation had spent £70,000 in purchasing the undertaking of the Airedale Gas Company, £56,000 on the Eccleshill and Bolton works, and £120,000 on the Clayton, Allerton, and Thornton undertaking. They had obtained powers to supply Heaton and Frizinghall through the Shipley Bill; and Thornton and Tyersal were getting their gas at the city rate. He thought they had now fulfilled all the promises they made to the out-districts when they took them in.

Heavy Gas-Works Expenditure at Driffield.—It is reported that since the acquisition of the undertaking by the Council, the expenses at the Driffield Gas-Works have gone up by leaps and bounds; and the increase has been so alarming that the Gas Committee appointed a Sub-Committee to inquire into the matter. At a meeting of the Council on Monday of last week, the following report was presented: "The Sub-Committee consider that the working expenses and purchases during the last two years have been heavy and excessive; that the Gas Committee and the Manager should use great care and supervision in the general expenditure in the current year, with the view of a material reduction; and that orders should not be given for work or goods unless the same are urgently required." The report was adopted.

London County Council and Subways.—At the meeting of the London County Council last Tuesday, the Highways Committee's scheme for a tramway subway from Holborn to the Victoria Embankment, to which reference was made in the "JOURNAL" for that date (p. 1225), was approved, and the following resolution passed unanimously: "That the Council do apply in the next session of Parliament (1) for powers to make subways in streets for the reception of pipes, wires, and other things, where desirable, and for electrical traction and other purposes of locomotion; and (2) for powers to construct a subway, and construct tramways therein, for electrical traction from the Victoria Embankment, along Wellington Street, across the Strand, through the new street thence to Holborn, under Holborn and Southampton Row, and to take such tramways, by an inclined plane, to the street level at a point in the centre of the carriage-way of Southampton Row, and thence to join with the existing tramways, belonging to the Council, in Theobald's Road." On the motion of Mr. W. Davies, Chairman of the Improvements Committee, it was agreed that before the scheme was submitted to Parliament his Committee should have an opportunity of reporting upon it to the Council.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1302.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME	Closing Prices.	Rise or Fall in Wk	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 11	10½	Alliance & Dublin 10 p.c.	19—20	..	5 5 0
100,000	10	,,	7½	Do. 7 p.c.	13—14	+½	5 7 2
300,000	100	July 1	5	Australian 5 p.c. Deb. .	100—102	..	4 18 0
200,000	5	Nov. 13	6½	Bombay, Ltd. . . .	6¼—6⅜*	+¼	4 16 4
40,000	5	,,	6½	Do. New, £4 paid	4¼—4⅜*	+¼	5 9 5
380,000	Stk.	Aug. 15	12	Brentford Consolidated	265—270	..	4 8 11
270,000	,,	,,	9	Do. New . . .	192—197	..	4 11 5
50,000	,,	,,	5	Do. 5 p.c. Pref. .	130—135	..	3 14 1
206,250	,,	June 14	4	Do. 4 p.c. Deb. .	114—117	..	3 8 5
220,000	Stk.	Sept. 12	10	Brighton & Hove Orig.	222—227	..	4 8 1
246,320	,,	,,	7	Do. A. Ord. Stk. .	155—160	..	4 7 6
1,047,500	Stk.	Aug. 28	5	Bristol, 5 p.c. max. .	119—120	..	4 3 4
420,000	20	Sept. 27	10	British.	41—42	..	4 15 3
50,000	10	Aug. 15	12	Bromley, Ord. 10 p.c. .	24—26	..	4 12 4
82,850	10	,,	9	Do. 7 p.c. . . .	19—21	..	4 5 8
500,000	10	Oct. 11	6	Buenos Ayres (New) Ltd.	9—9⅛	..	6 6 4
220,000	Stk.	June 28	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
150,000	20	July 17	8½	Cagliari, Ltd. . . .	22—24	..	6 17 6
100,000	10	Sept 27	10	Cape Town & Dis., Ltd.	14½—15½	..	6 9 0
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
550,000	Stk.	Oct. 11	12	Commercial Old Stock	270—275	..	4 7 3
236,425	,,	,,	9	Do. New do. .	203—208	..	4 6 7
238,237	,,	June 14	4½	Do. 4½ p.c. Deb.	130—135	..	3 6 8
800,000	Stk.	May 31	9	Continental Union, Ltd.	165—170	..	5 5 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	162—167	..	4 3 10
575,000	Stk.	Aug. 29	5	Crystal Palace Ord. 5 p.c.	122—127	..	3 18 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	123—128	..	3 18 2
486,090	10	July 17	10½	European, Ltd. . . .	19—20	..	5 5 0
354,060	10	,,	10½	Do. £7 10s. paid	14—15	..	5 5 0
15,079,885	Stk.	Aug. 15	4⅛	Gas-light and Coke { 4 p.c. Ord. . .	97—99	..	4 8 10
2,600,000	,,	,,	3½	{ 3½ p.c. max. .	88—90	..	3 17 9
3,799,735	,,	,,	4	{ 4 p.c. Con. Pref.	112—115	..	3 9 7
4,063,425	,,	June 14	3	{ 3 p.c. Con. Deb.	92—94	..	3 3 10
70,000	10	Nov. 13	8	Hongkong & China, Ltd.	13—14*	..	5 14 4
3,800,000	Stk.	Nov. 13	10	Imperial Continental .	211—216*	+4	4 12 7
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	100—102	..	3 8 8
561,000	Stk.	Aug. 29	10	Liverpool United A	231—233	..	4 5 10
718,100	,,	,,	7	Do. do. B	170—172	..	4 1 5
306,083	,,	June 28	4	Do. do. Deb. Stk.	119—120	..	3 6 8
75,000	5	June 14	4	Malta & Medn., Ltd. .	4½—5	..	4 0 0
560,000	100	Oct. 1	5	Met. of { 5 p.c. Deb.	105—108	..	4 12 7
250,000	100	,,	4½	Melbourne { 4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	Nov. 13	3½	Monte Video, Ltd. . .	9½—10⅜*	+⅛	6 13 4
717,946	Stk.	Aug. 3	8½	Newc'tle & G'tesh'd Con.	214—216	..	3 18 8
312,855	Stk.	June 28	3½	Do. 3½ p.c. Deb.	97—99	..	3 10 8
150,000	5	May 15	8	Oriental, Ltd. . . .	7¾—8¼	..	4 17 5
135,000	5	,,	8	Do. New, £4 10s. pd.	7—7⅜	..	4 16 0
15,000	5	,,	8	Do. do. 1879, £1 pd.	1⅛—1⅜	..	4 11 5
				* Ex div.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
60,000	5	Sept. 27	7	Ottoman, Ltd. . . .	5⅝—5¾	..	5 12 0
851,070	10	Oct. 11	7	River Plate Ord. . .	10½—11	..	6 7 3
250,000	Stk.	June 28	4	Do. 4 p.c. Deb..	95—97	−1	4 2 6
250,000	10	Sept. 27	8	San Paulo, Ltd.. . .	11—12	..	6 13 4
135,000	Stk.	Sept. 12	10	Sheffield A	242—244	+1⅜	4 2 0
209,984	,,	,,	10	Do. B	242—244	+1⅜	4 2 0
523,498	,,	,,	10	Do. C	242—244	+1⅜	4 2 0
5,761,885	Stk.	Aug. 15	5	South Met., 4 p.c. Ord.	123—125	..	4 0 0
1,627,965	,,	July 17	3	Do. 3 p.c. Deb. . .	91—94	..	3 3 10
380,940	Stk.	Nov. 13	5	Southampton Ord. . .	102—106*	..	4 14 4
70,825	,,	July 17	4	Do. 4 p.c. Deb.	104—109	..	3 13 5
120,000	Stk.	Aug. 29	5½	Tottenham and Edmonton { A. 5 p.c.	122—127	..	4 6 8
250,520	,,	,,	4	{ B. 3½ p.c.	95—100	..	4 0 0
182,380	10	Jan. 16	5	Tuscan, Ltd.. . . .	8—9	..	5 11 1
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	95—100	..	5 0 0
230,000	5	Aug. 15	9	West Ham, 10 p.c. . .	9½—10⅛	..	4 5 9
172,000	10	,,	6	Do. 7 p.c. . .	12½—13½	..	4 8 11
140,900	Stk.	June 28	4	Do. 4 p.c. Deb.	107—112	..	3 11 5
				WATER COMPANIES.			
780,599	Stk.	June 28	11	Chelsea, Ord. . . .	312—317	..	3 9 5
150,000	,,	,,	5	Do. 5 p.c. Pref. .	152—157	..	3 3 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	140—145	..	3 2 1
175,785	,,	Sept. 27	4½	Do. 4½ p.c. Deb. .	140—145	..	3 2 1
1,720,560	Stk.	Oct. 11	7	East London, Ord.. .	198—203	−2	3 9 0
654,740	,,	June 14	4½	Do. 4½ p.c. Deb. .	143—148	..	3 0 10
1,018,046	,,	,,	3	Do. 3 p.c. Deb. .	96—98	..	3 1 3
700,000	50	June 14	8	Grand Junction { 10 p.c. max..	115—118	..	3 7 10
310,000	Stk.	Sept. 27	4	{ 4 p.c. Deb..	122—126	..	3 3 6
708,000	Stk.	Aug. 15	14	Kent	297—302	+7	4 12 9
160,000	,,	,,	7	Do. New, 7 p.c. max..	200—205	..	3 8 4
1,043,800	100	June 28	10½	Lambeth, 10 p.c. max..	297—302	+2	3 9 6
406,200	100	,,	8	Do. 7½ p.c. max..	217—222	..	3 12 1
350,000	Stk.	Sept. 27	4	Do. 4 p.c. Deb..	125—130	..	3 1 7
500,000	100	Aug. 15	12⅛	New River, New Shares	395—405	..	3 3 2
1,000,000	Stk.	July 31	4	Do. 4 p.c. Deb..	125—130	..	3 1 7
902,300	Stk.	June 14	6	South-wark and Vauxhall { Ord. . . .	195—200	−3	3 0 0
126,500	100	,,	6	{ 7½ p.c. max.	185—190	..	3 3 2
489,200	Stk.	,,	5	{ 5 p.c. Pref..	147—152	..	3 5 9
1,019,585	,,	Oct. 11	4	{ 4 p.c. A Deb.	124—129	..	3 2 0
1,155,066	Stk.	June 14	10	West Middlesex. . .	290—295	..	3 7 10
200,000	,,	,,	4½	Do. 4½ p.c. Deb. .	138—143	..	3 2 11
200,000	,,	Sept 12	3	Do. 3 p.c. Deb. .	94—97	..	3 1 10
				* Ex div.			

Proposed Extension of the Sowerby Bridge Gas-Works.—As the consumption of gas at Sowerby Bridge is now almost equal to the productive power of the plant, the position is being seriously considered by the Gas Committee of the District Council, who, it is believed, will shortly submit a proposal for the erection of some inclined retorts.

Claim for Compensation by a Gas Manager.—Our readers are aware that Mr. William Duff will relinquish the management of the Morecambe Gas-Works at the end of the year. Under the Morecambe Gas Act of 1900, he is entitled to compensation for loss of office at any time within five years of the District Council taking over the works. He has accordingly lodged a claim for compensation amounting to £5993; and, acting on the advice of Mr. Thomas Newbigging, the Council made him an offer in settlement. Mr. Duff made a counter offer, which the Council refused to accept; and consequently the matter will now go to arbitration.

Dunedin Suburban Gas Company, Limited.—The accounts of this Company to the 30th of June last show that the balance to the credit of the profit and loss account, after having written off gas-works account £136 7s. 6d. for extensions of mains and services during the year, is £1307 15s. 3d. The amount brought forward was £267 1s. 1d.; making a total of £1574 16s. 4d. From this sum the Directors propose to distribute a dividend at the rate of 1¾ per cent. per annum, which will absorb £646 19s. 1d., and to place a further £600 to the reserve fund (which will then stand at £2200); leaving a balance of £327 17s. 3d.

The Affairs of the Welsbach Company.—Mr. W. W. Wright, the Secretary and Accountant of the Advisory Committee appointed to investigate the affairs of the Welsbach Incandescent Gaslight Company, Limited, has, at the request of the Committee, addressed a letter to the Secretary of the Company, requesting him, "as considerable anxiety is manifested by the shareholders with regard to the lengthy character of the investigations," to take such steps as may be advisable to inform them that the Committee are approaching the end of their labours, which have been of a most arduous and complicated nature, and are engaged in preparing their report, which they trust will be in the hands of the Directors for submission to the shareholders within a few weeks. The letter has accordingly been sent to the Press.

Fatal Accident at the Rotherham Gas-Works.—An inquest was held at Rotherham, on Monday of last week, touching the death of Tom Earnshaw, aged 37, an engine tenter, who was found dead in the new gas-tank at Rawmarsh Road on the previous Friday morning. The deceased was in the employ of Mr. Robert Snell, the Contractor for the works now under construction. Thomas Black, a bricklayer, said he found deceased in a sitting position dead at the bottom of the pit, between the shoring and the brickwork. Witness thought that he had been killed by having pitched off the wall. He could not say whether there were any lights near the spot. Mr. Snell gave it as his opinion that deceased had taken a straight cut instead of walking round a curve, and thus had fallen into the tank. The Jury returned a verdict of "Accidental death."

Wolverhampton Water Supply.—It is intended by the Wolverhampton Corporation to introduce a Water Bill in the forthcoming session of Parliament, on the same lines as the one rejected last session. Power will be sought to construct a well, boreholes for a pumping-station in the parish of Worfield, an aqueduct therefrom to a reservoir at Sedgley, a well or wells and pumping-station also at Worfield, with an aqueduct to Claverley, a tramroad from Cosford to Donnington, a reservoir at Tettenhall, adjoining the present reservoir, and a service reservoir at Sedgley. Authority will also be asked to use all such springs and waters as can be collected or taken by the proposed works, or any of them.

New Joint-Stock Companies.—Under the title of S. A. Sadler, Limited, a Company has just been registered with a capital of £100,000, in £1 shares, to adopt an agreement between Samuel A. Sadler and the Company for the acquisition of certain collieries in the county of Durham, called respectively Malton, Manor House, Hill Top, Lanchester, and Etherley Grange, and the coke-ovens and tar-works belonging to, or worked by, him; to develop the same; and to acquire and work any other collieries, construct coke-ovens and lime-kilns, and carry on the business of miners, smelters, iron and steel manufacturers, &c. There will be no initial public issue. The Chesterton Gaslight Company, Limited, has been registered with a capital of £6000, in £5 shares, with the object which is sufficiently indicated in the title. It is merely a re registration under the Companies Acts, 1862 to 1900, of a Company originally incorporated in 1859, pursuant to the Joint-Stock Companies Acts, 1856 and 1857. Under the title of Le Bunsen-Delin, Limited, a Company has been registered with a capital of £40,000, in £5 shares, to adopt an agreement with M. Arzt, and to manufacture gas-stoves made in accordance with a patent granted to him in France in March last year for the "Delin sur-carburateur." Among the subscribers are Messrs. Stevenson and Burstal.

Holsworthy Water Scheme.—Holsworthy being in need of a better water supply than at present exists in the locality, Messrs. Bellamy and Opie were called in to suggest a scheme; and they have now presented their report. A supply could not be obtained by gravitation, except on the east side, where, after a fall of 70 feet, the ground behind rises gradually until, at Simpson Moor, a height of 600 feet above sea level is attained. Here it is proposed to obtain a supply of water. At a depth of about 8 feet there is a bed of impervious clay, which arrests so much water that an abundance collects in the driest seasons. It is suggested that in this moor a storage reservoir for impounding the water should be constructed, and a pipe-track laid from thence to the town. From analysis, the water seems to be most suitable, being soft in nature and extremely palatable; and it is intended to provide a supply of 30 gallons per head per day for 1500 persons. The moor will be drained by open stoneware pipes into the storage reservoir, passing through filter-beds, screens, and weirs arranged so as to allow for cleaning out without stopping the supply. The reservoir is to contain 2,700,000 gallons; being a 60 days' supply. The approximate estimate for carrying out the scheme is £3892, exclusive of land purchase, compensation, and other matters not connected with the construction work.

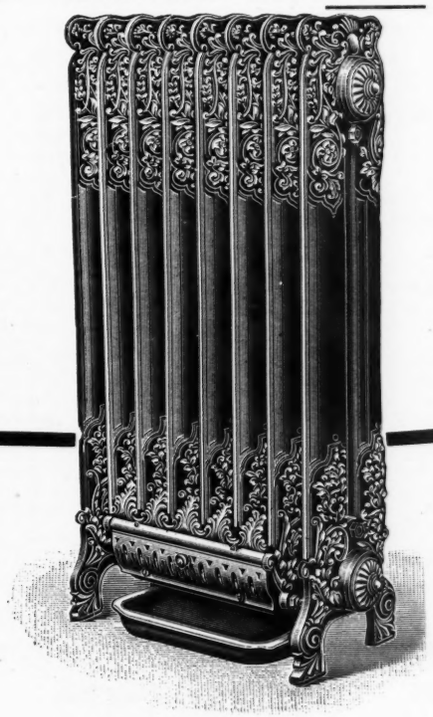
COMPARISONS ARE "ODOROUS"

WRIGHT'S CONDENSING STOVES ARE NOT.

HENCE

THEY ARE

ABOVE COMPARISON.



The "ST. PATRICK."

John Wright & Co.,

Essex Works,

Aston, Birmingham.

The Dover Dam Dispute.—The question of the River Dour water rights at Dover, to which reference has already been made in the "JOURNAL," has been settled by arbitration between the Corporation and the tanyard owner. The dam, it is officially reported, is to be removed, and the Corporation can then continue their scheme for deepening the river. The tanyard proprietor is to have the right to use the water and £250 compensation.

Leamington and the Gas-Works Purchase Question.—Last Saturday week, at the annual meeting of the Leamington Town Council, the General Purposes Committee reported that the Local Government Board had intimated that the Council could not be relieved of their obligation to purchase the gas-works by means of a Provisional Order; and they recommended that the Town Clerk be instructed to issue the notices necessary for the promotion of a Bill in the next session of Parliament for the purpose, and to also cover by such notices a number of additional local powers. A special meeting of the Council will be held to discuss the details of the proposed Bill.

A Public Lighting Question at Plymouth.—At the meeting of the Plymouth Town Council yesterday week, some discussion took place with reference to the lighting of a short length of roadway on the outskirts of the town. The Gas Company had been approached, and had offered to lay the necessary main if the Corporation were prepared to reinstate the roadway; but this offer the Electricity and Street Lighting Committee declined to accept. Mr. Long, one of the representatives of the ward in which the road is situated, expressed the hope that something would be done, as part of the road was very dangerous. Alderman Wills suggested that oil-lamps should be put up; but Mr. Winnicott pointed out that, while such lamps would not be so efficient, they would cost as much as reinstating the road. The Mayor (Mr. J. A. Bellamy), who is Chairman of the Gas Company, said he had made the position perfectly plain to Mr. Long. Gas companies were not bound to lay mains beyond a certain limit. Their undertakings were not carried on for philanthropic purposes, but on business lines. In this case the Directors offered to lay a main if the Corporation would pay half the cost. The Corporation declined; and the Company, desiring to meet the Corporation half way, then said they would do it if they were not put to the expense of reinstating the road. When this offer was also declined, the Directors said they would stand by their Act of Parliament, and lay the main as soon as there was business to be done. They could not be expected to lay mains where there were only two or three houses. Alderman Radford, Chairman of the Electricity and Street Lighting Committee, said the Committee were alive to the necessity of lighting the district, but they could not agree to the Gas Company's proposal. There had been insidious suggestions that the Corporation should contribute towards the cost of the Company's mains; and in this case there was the modified suggestion that they should pay for the reinstatement of the road. Perhaps the amount was not very large, but the principle was at stake. He would bring the matter before the Committee. Oil-lamps might be adopted; but they were expensive, and not very satisfactory. The matter then dropped.

Gas in Fog.—During the early hours of Tuesday morning, when the recent gale was at its height in Newcastle and Gateshead, the incandescent gas-mantles in one of the streets were so damaged by the wind that semi-darkness prevailed. In the side streets, however, the ordinary burners were unaffected, and produced a greater amount of light than their usually more brilliant neighbours.

Additional Capital for the Luton Water Company.—At an extraordinary meeting of this Company held last Thursday, the Directors were empowered to raise £5000 under the Luton Water Act of 1865, and £7500 under the Luton Water Provisional Order of 1880. It was explained that this would provide sufficient money for contracts in hand, and also be an investment for part of the reserve fund.

Abertillery Water Supply.—A statutory meeting of the Abertillery District Council has been held to consider whether the Council should promote a Bill in the coming session of Parliament for additional borrowing powers to complete the water-works at Cwmtillery. The new reservoirs were designed to hold 50 million gallons; and the contract was to be completed in two years from July, 1895. Unforeseen difficulties were, however, encountered. The original contract was £15,623: but up to May last £22,600 had been paid. Application was made for sanction to borrow £4500 to complete the work; but the Local Government Board advised that the Council should seek fresh powers by Act of Parliament. Messrs. G. H. Hill and Sons have recommended the construction of a new reservoir at a cost of £35,000, to supply 300,000 gallons more per day, which would ensure ample provision for the increasing population. It was unanimonsly resolved that a statutory meeting of ratepayers be held to decide as to a Bill to make further provision for the water undertaking, and also in relation to the supply of electricity, the erection of a refuse destructor, &c.

Wages of Gas Workers at Colne.—Some time ago, the Gas Workers' Union of Colne applied to the Corporation for an advance of the workmen's wages. At present they are being paid at the rate of 5½d. per hour, and they asked for an increase of ½d. At a recent meeting of the Gas and Lighting Committee, the Gas Engineer (Mr. F. Thorpe) submitted information with respect to wages being paid in other districts, and these having been compared with the rate in operation at the Corporation's works, it was decided that no alteration should be made. At the last monthly meeting of the Town Council, Mr. Paterson opposed the action of the Committee. He contended that they had looked at the question from an entirely wrong standpoint. He said it was not a matter of what was being paid in other towns, but one which should be considered upon the principles of supply and demand. The increase asked for would have made the wages of the men 25s. per week, and this he did not regard as unreasonable. He was sure the public would have no desire to sweat the employees. Mr. Newall asked Mr. Paterson if he would admit that the Colne gas workers were paid at a higher rate than those of the towns referred to. Mr. Paterson said no, not entirely so. In some cases the average amounted to a difference of about 3d. or 4d. per shift. The minutes of the Committee were, however, adopted.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
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The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cubic Feet Daily.		Cubic Feet Daily.
BLACKBURN	1,250,000	WINNIPEG, MAN.	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	COLCHESTER (Second Contract)	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	YORK	750,000
COLCHESTER	300,000	ROCHESTER	500,000
BIRKENHEAD.	2,250,000	KINGSTON, ONT.	300,000
SWINDON (New Swindon Gas Co.)	120,000	CRYSTAL PALACE DISTRICT	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	DULUTH, MINN.	300,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	CATERHAM	150,000
HALIFAX	1,000,000	LEICESTER	2,000,000
TORONTO	250,000	ENSCHEDE (HOLLAND)	150,000
OTTAWA	250,000	BUENOS AYRES (RIVER PLATE CO.)	700,000
LINDSAY (Remodelled)	125,000	BURNLEY	1,500,000
MONTREAL	500,000	KINGSTON-ON-THAMES	1,750,000
TORONTO (Second Contract; Remodelled)	2,000,000	ACCRINGTON	500,000
BELLEVILLE	250,000	TONBRIDGE	300,000
OTTAWA (Second Contract)	250,000	STRETFORD	500,000
BRANTFORD (Remodelled)	200,000	OLDBURY	300,000
ST. CATHERINES (Remodelled)	250,000	TODMORDEN	500,000
KINGSTON, PA.	125,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
PETERBOROUGH, ONT.	250,000	YORK (Second Contract)	750,000
WILKESBARRE, PA.	750,000	ROCHESTER (Second Contract)	500,000
ST. CATHERINES (Second Contract)	250,000	NEWPORT (MON.)	250,000
BUFFALO, N.Y.	2,000,000	TOKIO, JAPAN.	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

ORDERS RECEIVED IN 1901 TO MARCH 1 . . . . 3,500,000 CUB. FT. DAILY.

MALTON . . 150,000 Cubic feet. **SMETHWICK . . 500,000 Cubic feet.**

Incandescent Gas Lighting at Torquay.—On the recommendation of the Surveyor, the Torquay Town Council decided last Tuesday to adopt the incandescent system of gas lighting in the thoroughfares not lighted by electricity. The conversion of the lamps from the flat-flame to the incandescent system is to be carried out by instalments—a dozen lamps being taken in hand each half year. The Surveyor, in advising that the work should be done by the Corporation in this manner, said that in five years they would save £100, if they did it themselves.

Tees Valley Water Board.—The accounts of the Tees Valley Water Board for the past half year state that the capital expenditure during this period was £26,972, bringing the total cost of the undertaking up to £1,939,433. The sum received on capital account was £36,000; the total amount received up to date being £1,952,774, or £13,341 more than has been expended. The income was £46,021, or £996 less than in the corresponding period of the previous year. The balance carried to next revenue account was £37,157, as against £38,326. After bank charges had been deducted, there remained a balance of £60,546, including the sum of £26,364 brought forward from the previous half year. Of this amount, £39,000 was paid to the Corporations during the six months, leaving the sum of £21,546 to be carried forward, £15,000 of which had since been paid to the Corporations. Notwithstanding the small decrease in the past six months, the revenue for the year is the largest since the transfer of the undertaking in 1878; £42,801 having been the gross revenue of the first year's working, against £94,081 last year. The net revenue increased from £30,986 to £76,280. A commencement has now been made with the reservoirs at Grassholme and Longnewton.

The Period for which Municipal Loans are Granted.—Attention was drawn, at the meeting of the Plymouth Town Council yesterday week, to a striking example of the manner in which the practice of Parliament and that of the Local Government Board differ in regard to the length of time allowed for the repayment of the cost of public works undertaken by municipal authorities. When the Corporation went to Parliament for power to construct a new storage reservoir, they obtained through their Act permission to spread the repayment of the estimated cost over a period of 60 years. Owing to the difficulties which were met with, and to some enlargement of the original design, the estimated cost was exceeded by £90,657. Application was made to the Local Government Board for the necessary powers in respect of this portion of the cost; and sanction has now been received, with the proviso that the sum must be repaid in 30 years. The Town Clerk informed the Council that the difference in the rate of contribution to the sinking fund was about 2 per cent.; and, in consequence of the decision of the Local Government Board, the town would have to pay £2000, or a rate of about 1d. in the pound, over and above what Parliament thought it proper for the town to bear. The lack of principle in dealing with the repayment of capital charges was a matter needing serious attention; and application should be made to Parliament with a view to the practice of the various departments being brought into harmony with that of Parliament itself, so as to relieve the ratepayers of a part of their burden.

Teignmouth Water Supply.—A meeting of the ratepayers of Teignmouth was held last Tuesday, to consider the question of the water supply, in view of the apparent breakdown of the negotiations between the District Council and the Corporation of Torquay. Considerable discussion took place, with the result that two amendments, having for their object to secure an adjournment of the meeting, were defeated, and a resolution was adopted appealing to the Council to accept the Torquay offer as the cheapest obtainable. One of the speakers asserted that the town had never been in such a perilous position as now for want of water. If a fire occurred in the night, the morning would find them without a drop of water in the reservoirs. The Torquay Town Council met the same day, and received the report of the Water Committee on the negotiations with Teignmouth. Some members of the Council were in favour of withdrawing the offer; but the Mayor (Mr. Rockley) ruled that this could not be done without notice. The Council endorsed the action of the Committee in regard to the terms offered. Alderman Beavis said there was nothing generous in the offer; it was a business arrangement. The ex-Mayor added that Torquay had said its last word about concessions. If Teignmouth wanted cheaper water, it must go elsewhere. Application is to be made to the Local Government Board for a Provisional Order, which will be proceeded with if the Teignmouth District Council accept the Corporation's offer, and in the other event will be dropped.

An india-rubber tube attached to a gas-bracket has once more been requisitioned for the purpose of suicide. A coachman, at Sunderland, after fixing such a tube to a bracket, put it in his mouth, turned on the gas, and, covering his head with his jacket, deliberately suffocated himself.

At a recent meeting of the Elland District Council, it was decided to write to the Gas Company, asking if they are willing to sell their undertaking by arbitration; and the other Councils interested—Greetland, Stainland, Southowram, and Fixby—are to be invited to meet the Council to discuss the matter.

The Directors of the Wakefield Gaslight Company have decided to undertake the maintenance of Welsbach burners and mantles for their consumers at a small charge. They have also adopted the policy of supplying flat-flame burners, boiling rings, and braided flexible tubing, free, on application by any consumer.

Mr. Alfred Richards will offer for sale at the Mart, Tokenhouse Yard, next Monday, £10,000 of 4½ per cent. preference stock of the Swanage Gas and Water Company, and stocks and shares in the Aldershot Gas and Water Company, and the Lea Bridge, Pinner, and Southend Gas Companies—all being new issues—by order of the Directors.

The Public Works Loan Commissioners during the financial year 1900-1901 made 1684 advances for sums amounting together to £5,883,156, compared with 1751 loans for £7,247,670 in 1899-1900. Of the first-named sum, £5,825,871 was advanced on the security of local rates, and £57,285 on property.

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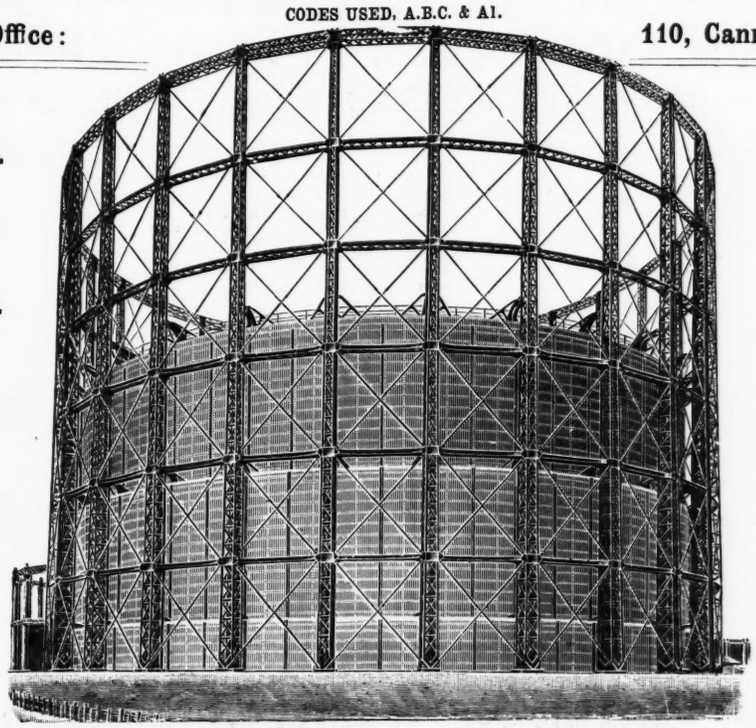

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SLIDE-VALVES, TAR-BURNERS, SIEVES.

GASHOLDERS.

The Kitson Lighting Company are opening a manufactory at Coventry, having taken part of the old Beeston Cycle premises.

The Directors of the Continental Union Gas Company, Limited, have decided to recommend to the proprietors, at the general meeting to be held on the 10th prox., dividends for the half year of 5 per cent. on the ordinary stock, free of income-tax, and of 3½ per cent. on the preference stock, less income-tax, making 9 and 7 per cent. respectively for the year.

It will be remembered that, in connection with the recent conference on water supply, an exhibition was held of sanitary appliances, among them being the principal filters which it was claimed would prevent infection. We learn that the Sanitary Institute, under whose auspices the exhibition was organized, have given the highest award—the silver medal of the Institute—for the Pasteur (Chamberland) Filter.

On the 11th inst., at the Rotherhithe works of the South Metropolitan Gas Company, the first concert of the season was held in the Workmen's Institute; the Superintendent of the Works (Mr. W. D. Hunter) presiding. An excellent programme had been provided by the Committee of the Institute; and it was carried out under the direction of Mr. H. Brown, the Institute's Secretary and Entertainment Manager.

The Town Council of Newport, Fifeshire, lately held an exhibition of Richmond's gas cookers and stoves. Provost Thomson expressed regret that the gas undertaking, which he felt was to be a valuable asset of the Council, had not been acquired by them many years ago. The Council promise to adopt a vigorous policy in the administration of the works, which they have newly acquired. For one thing, they are to fix cookers and stoves free of charge.

A special meeting of the Maidstone Water Company has been held for the purpose of authorizing the Directors to raise £15,000 of additional capital. Mr. H. W. Tyrrwhit Drake, who presided, stated that the additional capital was required chiefly to meet the cost incurred in sinking the new well at Forstal, but also for general expenses. The Company were making arrangements to extend the mains to all the higher parts of the borough. The new well yielded a splendid supply of water. A resolution was passed authorizing the Directors to raise the additional capital.

The temporary show-room occupied by the North Middlesex Gas Company in Station Road, Finchley, was so much appreciated by the consumers, that the Directors were advised by their Engineer and Manager (Mr. C. H. Rutter, Assoc.M.Inst.C.E) to establish a permanent show-room and office to meet the growing demands of the district. A suitable building was secured in the Broadway, and it has lately been opened. It is furnished with a great variety of burners, fittings, globes, shades, and stoves. There is a fine display of incandescent lighting, which makes the shop very attractive at night. Suspended from the ceiling is a triple-burner lamp which gives the light of 1000 candles. Along the kerb in front of the shops of the Broadway are self-intensifying burners in circular lanterns which illuminate the whole of the opposite terrace of shops.

It was recently stated that, notwithstanding the failure of the International Syndicate of Carbide of Calcium Producers, which was composed of German, Swiss, Scandinavian, and other Companies, an attempt was being made to form a new organization on lines which might benefit the industry in general. The negotiations in this direction have now so far proceeded that the success of the new Syndicate is assured. It will be found under the auspices of a limited Company with headquarters in Nuremburg; and, according to the "Allgemeine Zeitung," its constitution has been arranged on a firmer basis than that of the unsuccessful organization which was created a year ago, as the proprietors of the outstanding works have been induced to participate in the enterprise. The new Syndicate proposes to increase the price of carbide of calcium, and therefore the cost of acetylene gas lighting; but the question of counteracting this scheme is engaging the attention of large consumers. As the consumption of carbide in Germany amounts to 12,000 tons per annum and the capacity of the works to 75,000 tons, it will not be an easy matter to arrange the proportionate production of each of the syndicated works.

A report has been issued by the London Chamber of Commerce on certain bye-laws proposed to be made by the London County Council for "the regulation of lamps, signs, or other structures overhanging the public way, not being within the City." These bye-laws, which are issued under the London Building Act, 1894, will, when finally approved and confirmed by the Local Government Board, be administered by the Borough Councils, to whom they have meanwhile been submitted for consideration. A Special Committee of manufacturers and traders in the principal businesses in London was formed under the auspices of the Chamber of Commerce to examine and report upon the proposed bye-laws, and this Committee have indicated various objections to them, and suggested a number of amendments. At the close of their report, they make the following general observations: "The Committee are of opinion that the bye-laws as drafted would injuriously affect the great bulk of traders within the County of London (and several industries concerned in the supply of lamps, signs, and other accessories) coming within their scope. The traders concerned are large contributors to the rates, and resent the interference thus contemplated in the free prosecution of their business. They object absolutely, on principle, to the provisions in the bye-laws involving the special 'sanction' of the local authority in matters of every-day necessity and established custom in trading communities, except so far as may be needed for the public safety. Moreover, the bye laws are an innovation, and if applied retrospectively (without amendment) will cause immediate inconvenience, expense, and even loss to many traders, in whose businesses outside lamps, signs, and similar structures are useful adjuncts alike to them and to the public generally." On the grounds set out, "the Committee confidently submit their proposed amendments to the earnest consideration of the Metropolitan Borough Councils and the London County Council, in the belief that, if modified in the manner indicated, the bye-laws will enable the authorities to exercise all necessary control for the protection and well-being of the public, without unduly curtailing the liberty of traders."

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Giving a Lighting Efficiency of 300 CANDLES PER BURNER with about 10 Cubic Feet of Gas

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PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
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Can be Exchanged for Spent Oxide.
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For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
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H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
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Address 51, Cromer Road, Watford, HERTS.

WANTED a Working Gas Manager for Small Works.
Apply to W. ROSE, CLEOBURY MORTIMER.

GAS-METER Testers, both Wet and Dry, wanted.
Apply to the SUTHERLAND GAS-METER COMPANY, Essex Works, Aston, BIRMINGHAM.

WANTED, a Young Man who can lay Services, Fix Meters, and do general Pipe Work in a Gas-Works. Applicant must state Age, Experience, and Wages expected.
Apply to the ENNISKILLEN GAS COMPANY, IRELAND.

WANTED, a good all-round House GAS-FITTER. Must be used to Chandeliers, Fires, &c. Wages 32s.
Apply, by letter, with Particulars, to No. 3778, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a General Fitter for Main and Service Laying and Prepayment Fitting. Permanent job for a good Man.
Apply, by letter, stating Age and Wages required, to No. 3777, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GOOD all-round Fitter wanted, used to Prepayment Meters and Cooker Fixing. One with a knowledge of Smithing preferred.
Applications, in own handwriting, stating Experience and Wages required, to the MANAGER, Gas-Works, Irthlingboro', NORTHANTS.

WANTED, a Man to set Retorts and do general Bricklaying at Works near Birmingham. Must be used to Regenerative Settings. Permanent Situation to suitable Man.
State Age, Experience, Wages required, &c., to No. 3753, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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THE Morecambe Urban District Council require a MANAGER to take sole charge of the above Works and Undertaking. He is to enter upon his duties early in 1902. Salary £150 per annum, with House, Fuel, Rates, and Gas Free.
Applications, stating Age and Experience (accompanied by not more than three Testimonials), to be sent to me in sealed envelope, endorsed "Gas Manager," on or before the 16th of December, 1901.
WM. TILLY,
Clerk.
Urban District Council Offices,
Morecambe.

SHARES Wanted in C. & W. Walker, either Preference or Ordinary.
State Number for disposal and Price required to No. 3779, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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WANTED, Second-Hand, Two Purifiers, about 30 to 36 superficial square feet area each, and Connections.
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Apply to the GILLROYD MILLS COMPANY, LTD., Morley, near LEEDS.

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Four PURIFIERS, 10 feet square, in line, with Planed Joints, Walker Centre-Valve, Covers, and Traversing Crab Lifting Gear. Will be refixed equal to new.
Write J. WRIGHT, Bridge House, BLACKFRIARS, E.C.

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One length of SECONDARY MAIN, with Branches complete for attaching to Dip-Valves.
Eighteen OVAL SELF-SEALING MOUTHPIECES, with Screw Arrangement.
Three CAST-IRON BACKSTAYS, with Shoes complete.
Eighteen ASCENSION-PIPES.
Eighteen "H" PIPES.
Three FURNACE DOORS and FRAMES.
Offers invited for same.
The Articles can be seen, if desired, at the Hoylake Gas-Works.
Offers to be received by Monday, the 25th inst., to be addressed to the Chairman of the Company at the Gas and Water Offices, Hoylake, Cheshire.
Nov. 11, 1901.

THE Broughty Ferry Gas Council desire OFFERS for the supply of 40 Tons of SULPHURIC ACID, to be delivered between the present and the 1st of May next.

Particulars from, and offers not later than the 23rd inst. to,

FORBES WADDELL,
Engineer and Manager.

THE Broughty Ferry Gas Council will have FOR DISPOSAL, from the present till the 15th of May next, about 30 to 40 Tons of SULPHATE OF AMMONIA.

Tenders not later than the 23rd inst. to

FORBES WADDELL,
Engineer and Manager.

J. FIRTH BLAKELEY & CO., Thornhill, Dewsbury, have FOR SALE cheap—

ANNULAR CONDENSERS up to 16-in. Connections.
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THE Bridgewater Trustees are pre pared to receive TENDERS for the TAR produced at their Coke-Works for a period of Six or Twelve Months, from the 1st of January next, delivered into Contractor's Tanks at the Trustees' Brackley Siding on the Little Hulton Mineral Branch of the L. & N.W. Railway; or their Wharton Hall Siding on the Pendleton and Hindley Branch of the L. & Y. Railway.

Tenders, endorsed "Tender for Tar," to be addressed to the Bridgewater Trustees, 4, Chapel Walks, Manchester, and to be delivered on or before the 30th of November.

FIRE-CLAY GOODS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of SILICA and FIRE-CLAY GOODS, required at their Neepsend, Effingham Street, and Grimesthorpe Stations during the next Twelve Months.

Specifications and Forms of Tender may be had on application to the Company's Engineer, Mr. J. W. Morrison.

The Directors do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, marked "Tender for Fire-Clay Goods," must be delivered by post to the undersigned not later than the first post on Saturday, Nov. 30.

HANBURY THOMAS,
General Manager and Secretary.

Commercial Street,
Sheffield, Nov. 11, 1901.

TO RETORT MANUFACTURERS.

THE Bradford Corporation are pre pared to receive TENDERS for the supply of RETORTS, and of FIRE-BRICKS and FIRE-CLAY required in the fixing of such Retorts, during the Year 1902.

Form of Tender may be obtained on application at the Gas Office, Town Hall, Bradford.

Tenders, endorsed "Tender for Retorts," to be sent to me on or before Thursday, the 28th inst.

Persons tendering must give an assurance that they have paid to their workmen for the three months preceding date of Tender not less than the minimum Standard Rate of Wages, and undertake to continue to pay during the Contract the said Rate of Wages.

The lowest or any Tender will not necessarily be accepted.

FREDERICK STEVENS,
Town Clerk.

Town Clerk's Office, Bradford,
Nov. 13, 1901.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

LEA BRIDGE DISTRICT GAS COMPANY.

NEW ISSUE OF £8000 CONSOLIDATED ORDINARY STOCK AND £2560 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

ALDERSHOT GAS AND WATER COMPANY.

£5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTHEND GAS COMPANY.

NEW ISSUE OF £5000 NEW ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

PINNER GAS COMPANY, LIMITED.

NEW ISSUE OF 400 £5 ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SWANAGE GAS AND WATER COMPANY.

NEW ISSUE OF £10,000 FOUR-AND-A-HALF PER CENT. PREFERENCE STOCK (£5000 being "Water" Preference and £5000 being "Gas" Preference).

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors of the

WITNEY GASLIGHT AND COKE COMPANY, LIMITED.

NEW ISSUE OF 156 £5 SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Monday, Dec. 2, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £4805 ADDITIONAL "B" CONSOLIDATED STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Dec. 2, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF £4000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK AND 300 £10 NEW ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION at the Mart, E.C., on Monday, Dec. 2, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

ILFORD GAS COMPANY.

NEW ISSUE OF £10,000 ORDINARY "C" STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Dec. 9, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

CITY OF RIPON.

THE Gas Committee of the Ripon Corporation invite TENDERS for the supply of GAS-MAINS.

For Particulars, apply to Mr. Anderson, M.Inst.M.E., Gas Manager, Ripon.

Tenders, to be marked on the outside "Tenders for Gas-Mains," must be sent in to me on or before Wednesday, the 27th of November inst.

The acceptance of the lowest or of any Tender is not guaranteed.

M. KIRKLEY,
Town Clerk.

Town Hall, Ripon,
Nov. 17, 1901.

ASHTON-IN-MAKERFIELD URBAN DISTRICT COUNCIL.

GAS-WORKS EXTENSIONS.

THE Ashton-in-Makerfield Urban District Council are prepared to receive TENDERS for carrying out the following Works in connection with the extension of their Gas-Works—viz., Providing and Erecting RETORT-SETTINGS complete, making CONNECTION to present CONDENSER, ALTERING present FOUL MAIN and PURIFIER CONNECTIONS, providing New PURIFIERS, MECHANICAL WASHER-SCRUBBER, ALTERING present SCRUBBER, and providing and fixing a duplicate EXHAUSTER.

Persons tendering are to submit with their Tender Drawings and Specifications setting forth in detail full Particulars of what they propose to erect for the amount quoted.

Further Particulars may be obtained from Mr. Niven, Gas Manager, at the Gas-Works, or from the undersigned.

Sealed Tenders, endorsed "Gas," to be sent to the undersigned, at the Council Offices, Bryn Street, Ashton-in-Makerfield, on or before Thursday, the 28th day of November, 1901.

The Council do not bind themselves to accept the lowest or any Tender.

ALBERT SYKES,
Clerk to the Council.

Council Offices,
Ashton-in-Makerfield,
November, 1901.

GAS COMPANIES' BOOK-KEEPING.

A PRACTICAL TREATISE ON THE KEEPING OF GAS COMPANIES' ACCOUNTS.

By JOHN HENRY BREARLEY, of Longwood, and BENJAMIN TAYLOR, of Cleethorpes.

The only complete Treatise on Gas Companies' Book-Keeping ever published.

This book will be found invaluable to those desirous of obtaining a thorough grasp of Gas Companies' Book-Keeping and Accountancy.

A complete set of Transactions are dealt with; the same being entered into the various Books, and posted into the Ledgers. A Model Balance-Sheet is prepared from the set of transactions and postings.

Forms and subsidiary books are illustrated and described. The linking together of the various books is shown at a glance by means of a Chart.

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Gas Engineer's Magazine.—"It is difficult to speak too highly of the clearness in which the authors have set down every detail. The 'Model set of Books' appear to us to be about as complete as experience and careful thought can make them. The authors have placed within the reach of every official of a Gas Undertaking, a book that we venture to prophesy will become a standard work, and will prove the guide, philosopher, and friend of all those who are engaged in the keeping of gas-works accounts."

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SOUTH SHIELDS GAS COMPANY.

IMPORTANT SALE OF GAS STOCK.

MR. M. STAINTON
is instructed by the Gas Company to
SELL BY PUBLIC AUCTION
AT THE
OFFICES OF THE COMPANY,
CHAPTER ROW, SOUTH SHIELDS,
ON TUESDAY, DEC. 3, 1901,
at 12.40 o'clock, p.m.,
£8000 OF NEW STOCK
UNDER THE SOUTH SHIELDS GAS ACT, 1886.

THE Stock will be put up in Lots of £100 each, nominal value. A deposit of £10 per cent. to be paid on the purchase money at the sale, the remainder to be paid to the Company's Bankers, the North-Eastern Banking Company, Limited, King Street, South Shields, on or before the 31st of December next.

The Stock will be registered in the name of the purchaser free of expense, and will rank for Dividend from the 1st of January, 1902.

By order of the Directors,
J. H. PENNEY,
Secretary.

Gas Offices, Chapter Row,
South Shields, November, 1901.

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Above the Average in Weight and Quality of Coke.

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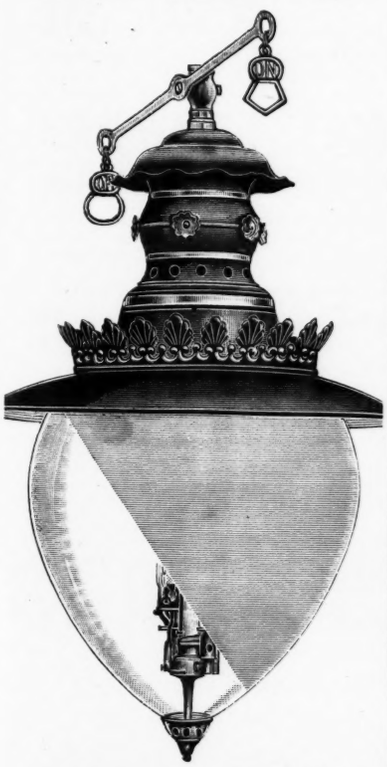

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1 cwt. 15/- per cwt.
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PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

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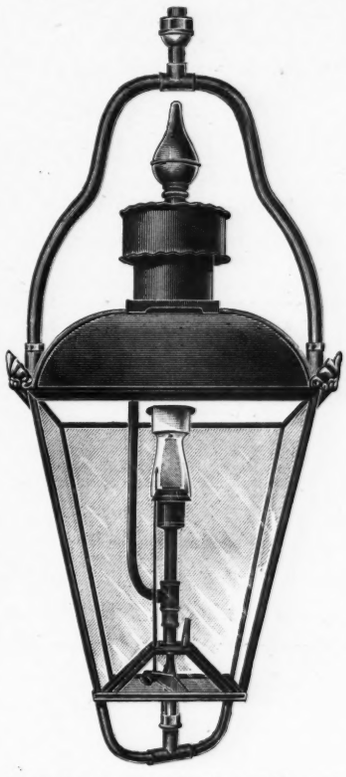

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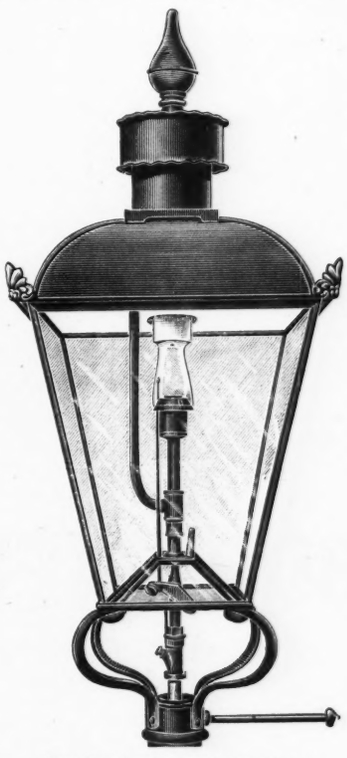

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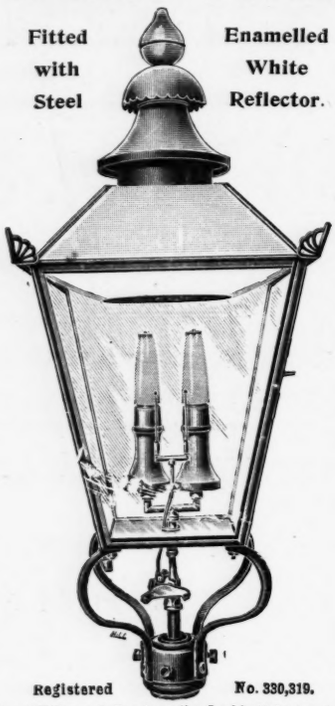

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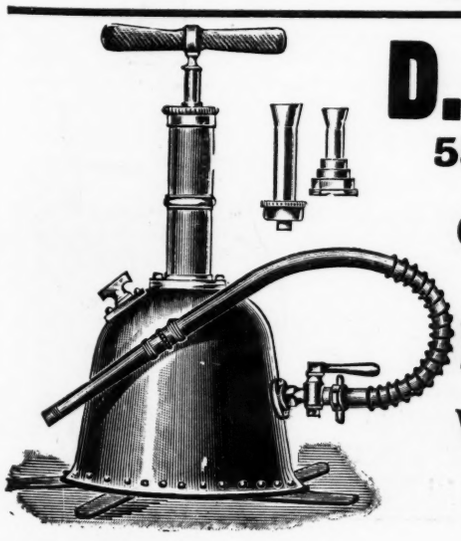

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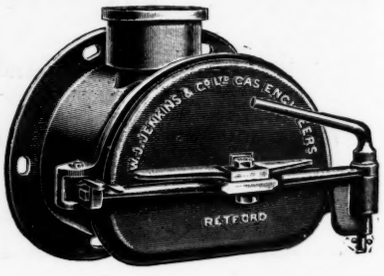

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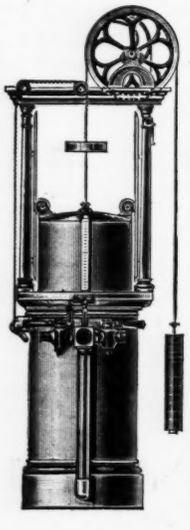

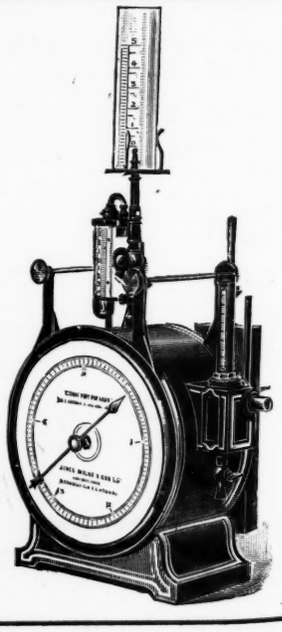

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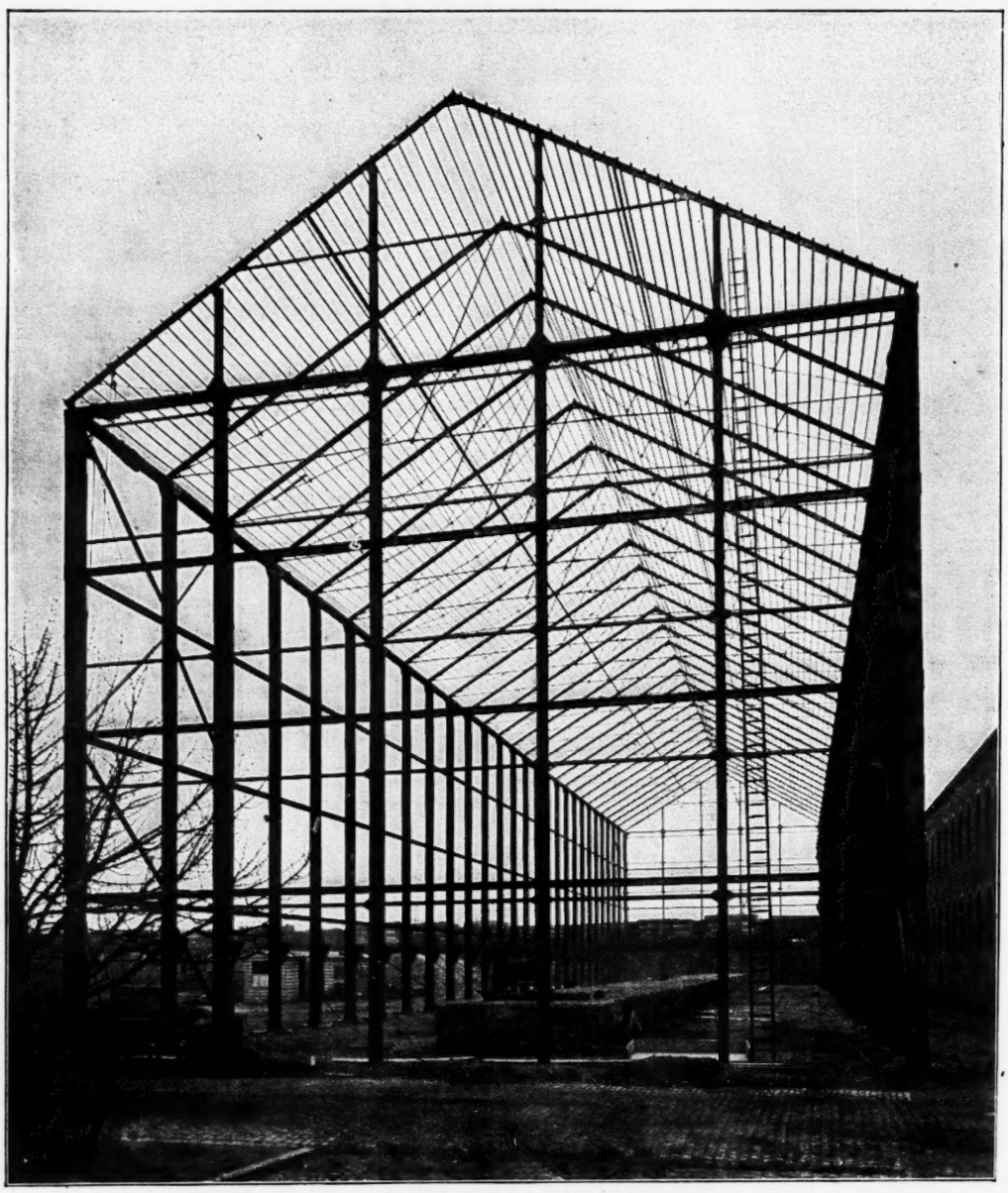

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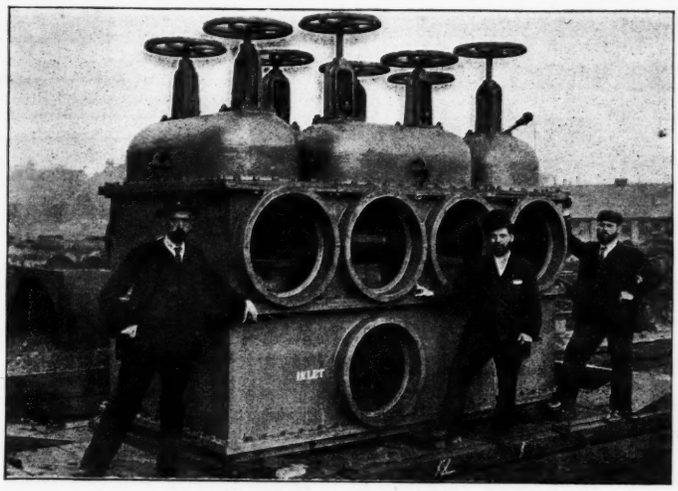

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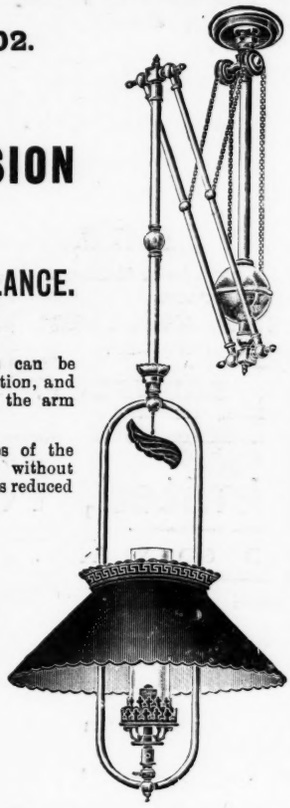

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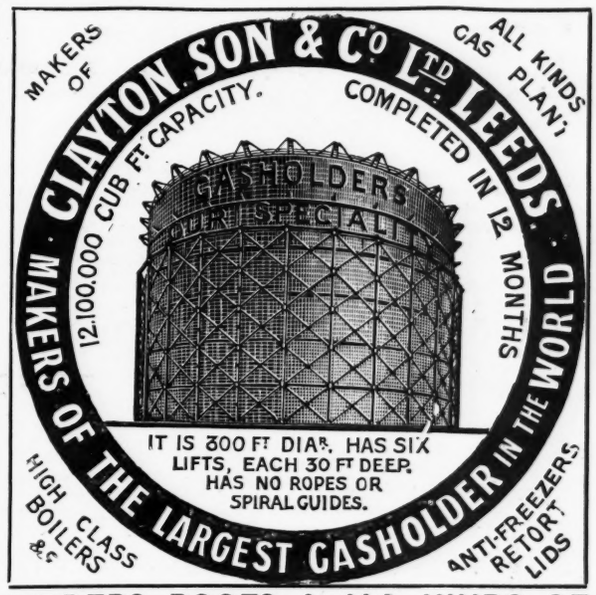
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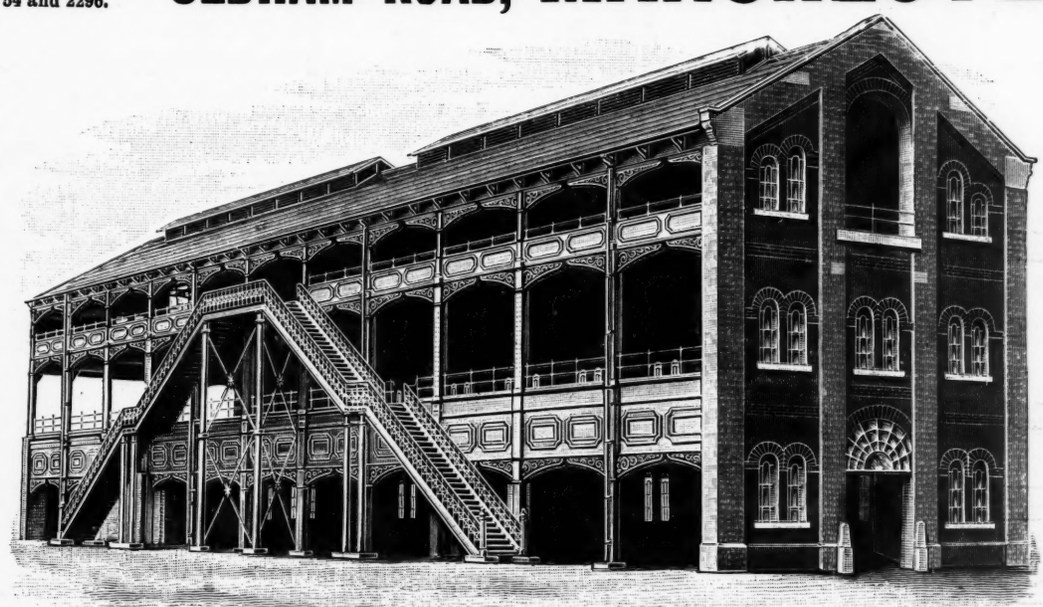

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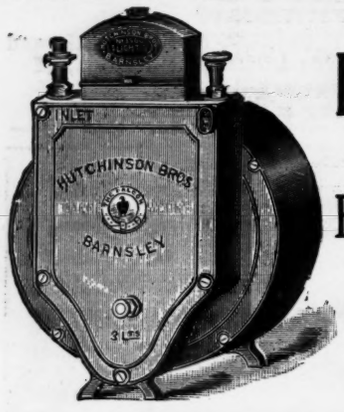

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